ELECTRICAL REVIEW
AND
WESTERN ELECTRICIAN

VOL. LIX, No. 27. CHICAGO, SATURDAY, DECEMBER 30, 1911. ISSUED WEEKLY

BY THE
ELECTRICAL REVIEW PUBLISHING COMPANY

CHARLES W. PRICE, President and Treasurer.
A. A. GRAY, General Manager. H. S. TUTHILL, Secretary.
C. W. FORBRICH, Assistant Treasurer.

PUBLICATION OFFICE: MARQUETTE BUILDING, CHICAGO

EASTERN DEPARTMENT . . . . . 13 Park Row, New York.
E. E. Wood.
EUROPEAN OFFICE . . . . . 42 Old Broad Street, London, E. C.
Henry W. Hall, Manager.

CHARLES W. PRICE.....Editor-in-Chief
A. A. GRAY.....Managing Editor
MORTON GITHENS LLOYD.....Technical Editor
F. H. BERNHARD.....Associate Editor
HOWARD EHRLICH.....Associate Editor
C. H. SEAVER.....Associate Editor

SUBSCRIPTIONS.

One Year, United States	$3.00
One Year, Canada	4.00
One Year, Foreign Countries	6.00
Single Copy, 10 cents. Back numbers, beyond one month, each	.25

Entered as second-class matter, November 7, 1908, at the Post Office at Chicago, Ill, under the Act of March 3, 1879.

CONTENTS.

EDITORIALS:
Tungsten Lamps in the Lighting of Roadways 1313
Wiring for Bedrooms..... 1313
Electricity in the Wholesale District 1314
National Electric Light Association Membership Reaches 10,000 Mark..... 1315
Resuscitation from Electric Shock..... 1315
The Production and Distribution of Energy in a Large Community.. 1316
Commission to Study Resuscitation from Electrical Shock Formed.. 1316
Proposed Changes in the Patent System..... 1316
Victoria Falls Power Company Building Fourth Station..... 1316
Growth of the Coal Production..... 1316
Sir William Crookes..... 1317
Joint Meeting of Lighting Societies in Chicago..... 1318
Program for Byllesby Convention..... 1318
Electric Ore-handling Plant for Cleveland..... 1318
McKinley Traction Lines Approach Chicago..... 1318
Hydroelectric Development of the Salt River Project..... 1319
Philadelphia Section, Illuminating Engineering Society..... 1329
Nela Engineering Society Lectured on World Tour..... 1329
New York Electrical Contractors Plan Big Celebration..... 1329
Measurement of Electrical Energy by Recording Watt-hour Meters. II.—By Joseph B. Baker..... 1330
Electricity on the "Sunset Limited"..... 1334
Reconstruction of the Rockford Central Station Completed..... 1334
Peat as Fuel..... 1335
Winnipeg Lighting Rates Reduced..... 1335
Outdoor Transformers and Switching Stations.—By Stephen Q. Hayes 1335
New Plant for Battle Creek..... 1338
Another Municipal Lighting Plant Failure..... 1338
Installing a High-Power Switchboard in a Limited Space 1338
Lectures on Illumination and Photometry..... 1338
New York Edison Educational Display in Christmas Decoration..... 1339
Some Observations on Telephone and Telegraph Practice in England, May and June, 1911.—By Angus S. Hibbard..... 1340
Professor Bell's Telephone Prophecies of Thirty Years Ago..... 1341
Telephone Transmission Engineering—By Frank B. Jewett..... 1342
Battery Economy.—By E. E. George..... 1343
Water Does Not Always Give Good Telephone Ground..... 1343
Competing Telephone Companies at San Francisco Ask Permission to Merge 1343
BOOK REVIEWS 1344
California Passes Utility Law..... 1345
Public Service Discussed at Los Angeles..... 1345
Nova Scotia Power Companies Unite..... 1345
Doherty Company Purchases Texas Property..... 1345
NEW ELECTRICAL AND MECHANICAL APPARATUS AND APPLIANCES..... 1346
CURRENT ELECTRICAL NEWS..... 1353
PUBLIC SERVICE COMMISSION NEWS..... 1353
RECORD OF ELECTRICAL PATENTS..... 1359

Copyright 1911, by the Electrical Review Publishing Company.

THE TUNGSTEN LAMP IN THE LIGHTING OF ROADWAYS.

While localized illumination is often necessary in the lighting of interiors, it is relatively infrequently desirable in street and roadway lighting. With rare exceptions, indeed, the more nearly uniform the distribution of the light in the latter class of illumination, the more satisfactory and efficient is the service. This fact, it may be remarked, has contributed in no small measure to the present popularity of the electric incandescent lamp as an outdoor illuminant. It appears, however, that although engineers are practically unanimous in recommending the ornamental tungsten standard for the illumination of the more densely populated and business sections of cities and towns, there is not yet an adequate appreciation of the adaptability of the street series tungsten lamp for the lighting of roadways and outlying residential districts. It is interesting, therefore, to inquire into the cause of this apparently existing condition, and likewise to note results which have been obtained with certain tungsten installations made for the purposes just mentioned.

Where single-lamp tungsten units have been employed in lighting roadways and suburban streets, the lamps have hitherto been installed, oftener than not, by means of iron brackets on poles along the side of the thoroughfare to be lighted. Such an arrangement, unless lamps be placed on both sides of the street or roadway, thus often making the cost of the circuit relatively high, is quite liable of course to result in one side of the street being poorly illuminated. Moreover, the light distribution is very often seriously interfered with by the presence of trees and dense foliage. In order to overcome these disadvantages the center-suspension street series fixture was developed and placed on the market; but engineers have been quite generally disposed to the opinion that this fixture was not well adapted to withstand the effects of high winds, and hence in recent discussions of street lighting the center-suspension incandescent lamp has received little or no attention. Nevertheless, this type of lighting unit has been adopted in the residential districts of a number of the smaller towns of the Southwest where unusually high winds are frequent, and practically no trouble at all has been encountered. The most generally employed method of installation, consisting as it does of suspension

of the lamp between two poles on opposite sides of the street, the conductors forming the support from one side and a rope or cable that from the other, is naturally quite inexpensive and seems to be better than a more rigid support. It is stated that the blowing down of one of these lamps is a very unusual occurrence. The reflectors used turn a very large percentage of the total light of the lamp into useful directions. Thus an illumination of remarkably uniform distribution, and of pleasing appearance as well, is being made possible in localities where the cost of securing results at all comparable with these by means of other types of outdoor illuminants would often be prohibitive. It seems, then, that the center-suspension street series tungsten lamp possesses many features to commend its more general adoption in the lighting of roadways and the remoter sections of the smaller towns, particularly where low initial and operating costs must be obtained and good light distribution at the same time insured.

WIRING FOR BEDROOMS.

In laying out the wiring circuits for a residence, very little attention is sometimes given to the bedrooms, with the result that entirely inadequate provision is made for the use of electrical devices in that portion of the house. In many houses of modest design a single outlet is provided in each bedroom, no recognition being given to the fact that it may be a great convenience to be able to use some form of heating apparatus as well as a lamp in such a room.

The electric shop today provides a variety of current-consuming devices intended for the bedroom, and the housewife of the near future will find herself sadly handicapped if she has but a single socket to which to make attachments. It is true that a plug cluster can be brought into service to enable more than a single device to be used on one outlet, but the existence of such a device is not always known to the lay user. The result may be that apparatus that would otherwise be purchased will be refused because it is thought that there are no facilities for making use of it. If these facilities were provided many electrical devices would become everyday necessities in the bedroom and boudoir.

An electric shaving mug is very serviceable in homes where hot water is not always on tap, and in connection with the shaving mirror it is quite handy to have an electric light whose position may be adjusted to render the best service. The electric curling iron and the electric hair dryer appeal very strongly to the ladies of the house, the former having distinct advantages over the curling iron which has to be heated by gas with the accompanying soot and danger of excessively high temperature. The electric vibrator is another apparatus which will function in the bedroom, if it be used at all. Fans, ozonizers, radiators and other common devices may also be wanted in this part of the house. To many persons a reading lamp which can be placed in a convenient position at the bedside is also a great comfort and convenience. It must thus be evident that the provision of a number of outlets is just as desirable in the bedroom as in any other portion of a residence, and if the greatest use is to be made of electric current the contractor or designer of an installation should bear all these points in mind when laying out his wiring scheme.

ELECTRICITY IN THE WHOLESALE DISTRICT.

Considering the extent of central-station commercial developments in the field of retail business, it is surprising that so much must yet be done before electricity can take its proper place in many wholesale districts. The latter form striking contrasts with the sections of cities where the great public surges to and fro in search of the bargain counter, when the relative effectiveness of electrical applications receives attention. It is time that the special usefulness of electric power and lighting in the wholesale district should be more generally appreciated, for the sale of current in this field is profitable if handled upon a sound engineering basis, even though the lighting peak may overlap other demands upon the company for illumination for two or three hours in the winter season.

At present most people avoid the wholesale district of a large city unless forced to go there for compelling business reasons. The poor lighting and bad paving are in no small degree responsible. Dingy sidewalks obstructed by the manual handling of merchandise, dull old buildings unrelieved by electric sign or window lighting, and excessive turmoil in general repel the curiosity of the visitor and largely nullify the effect of even the small amount of effort put forth to draw potential customers into the region. This is only one side of the question, however, and the real need of the improved service which electricity alone can furnish rests upon the savings which it stands ready to give to the occupants of the district itself, in the shape of more efficient handling of merchandise, better illumination and the general toning up of the area.

In large cities the increasing value of property in the business sections and the tendency of wages to rise impose serious problems upon mercantile houses handling considerable quantities of manufactured products and raw materials. Quick turn-overs become necessary, and small savings in transportation and shipping become important in the mass. The opportunity of electricity here is much the same as in the great industrial plant. What has been done with the motor drive in the factory can be accomplished as well in the great shipping and storing centers, through the installation of modern types of hoists, elevators and telphers, the provision of motor-operated trucks where long runs are required, and the substitution of the electrically driven tool for the installation at present too often operated by complex belting and shafting layouts driven by an inefficient steam engine located two or three hundred feet away from the work. As things are now, altogether too many

buildings in the wholesale district are without passenger elevators; stairways are scarcely better lighted on a rainy night than the catacombs; human muscle and animal vigor are trying to cope with the handling of material of great bulk and value at a speed which really demands the accelerating power of the electric motor; and the streets are cumbered with slow-moving vehicles whose frequent blockades testify to the need of applying more scientific devices and methods to the volume of traffic which must be handled in the face of many obstacles.

Without good illumination, little can be accomplished in the line of improving operations in the wholesale district. Both interior and outside lighting must be taken in hand and completely revolutionized in many cases. It is not enough that a few additional street lights shall be placed between street corners, thus increasing the inter-block illumination, badly as that is needed. Roughly speaking, the central-station man has a chance here to pretty much make over his territory. In innumerable establishments the street numbers and firm or corporation signs are difficult to read; the windows are blocked with packing cases and the premises equipped with a few flaring gas burners of the open-flame type; time is lost by teamsters in deciphering labels and addresses on merchandise by the light of the aforesaid gas jets or by ill-smelling and dangerous oil lanterns; alleys leading to shipping platforms are dark and congested because of the lack of light; and even the interiors of offices are scarcely better lighted than the average railroad-station waiting room. By introducing modern standards of illumination, the central-station solicitor can open the way to a general application of electric power. The electric sign will enter a field in which its flexibility of specialized service will accomplish surprising results; and the high-powered tungsten lamp with a carefully planned reflector equipment will literally turn night into day in such a district. The flaming arc lamp also can be used to great advantage in connection with the improvement of shipping conditions, and all of the present uncertainty of the handling of material changed to quick and straightforward manipulation. In many establishments the facilities for lighting and handling of goods are now so poor that the cost of great improvements will be relatively small, and the result of an extended electrical service will be the development of a class of business which will add largely to central-station revenue.

The rapid increase in the number of electric vehicles, both of the pleasure and commercial-truck and delivery-wagon types, seen in every section of the country, is a sure indication of the response on the part of the public to the co-operative campaigns now being carried out by the central stations and the builders of electric vehicles and the manufacturers of accessory devices. This concert of action was slow of starting, but once under way it is producing very satisfactory results.

NATIONAL ELECTRIC LIGHT ASSOCIATION MEMBERSHIP REACHES TEN THOUSAND MARK.

Announcement is made that the long looked for figure in the membership roll of the National Electric Light Association has been reached, the grand total as of December 15 being 10,065 net. This is the beginning of a complete organization of the industry, and the divisions of membership are made up as follows: Class A, 982; Class B, 7,870; Class C, 41; Class D, 238; Class E, 934. But for the consolidations which have taken place at many points, the membership of operating companies would have reached the 1,000 mark. During the month the Michigan Electrical Association was added and formal recognition given to the Eastern New York Section. This sectional work is greatly increasing the usefulness of the national organization, and in turn is bringing to the smaller central stations resources in dealing with problems that are daily becoming more complex.

The Commercial Section of the National Electric Light Association, although the most recent departure of effort, is growing in an extraordinary fashion and bids fair to become one of the most important developments undertaken by the Association. The establishment of offices in New York for a central bureau of the Commercial Section marks the beginning of some very strong promotion work which will realize within the coming year without doubt the most invigorating stimulus that has ever been given for the bringing together in a co-operative effort the work of every department involved in the manufacture and sale of electrical energy and current-consuming devices.

RESUSCITATION FROM ELECTRIC SHOCK.

It is with much satisfaction that we learn of the selection of a commission of professional medical men and engineers to make a study of methods of resuscitation from electrical shock and preparing a report for the guidance of the public, and particularly those whose business brings them into proximity with electrical conductors.

The National Electric Light Association has taken the initiative in this important work, and although the selection of the committee has been left to the governing body of the American Medical Association, the nominations from the membership of the National Electric Light Association and the American Institute of Electrical Engineers contribute very materially to the high professional standing of the commission thus organized.

The work of the committee will go forward expeditiously, and it is very likely that it will assume an international character and that shortly there will be adhesions to the commission of noted foreigners who are giving much attention to this important subject. The eminent medical men named on the commission, together with the engineers, all of whom have a world-wide reputation, assures a research that will redound to the great benefit of the entire industry.

The Production and Distribution of Energy in a Large Community.

At the semi-annual banquet of the Alumni Association of Armour Institute of Technology which was held in the Hotel Sherman, Chicago, on the evening of December 19, Samuel Insull, president of the Commonwealth Edison Company, delivered an address on "The Production and Distribution of Energy." Space permits reference to but a few of the many valuable points brought out in the address.

In a rapid review of the development of the central-station industry Mr. Insull pointed out the enormous strides that had been made from the extremely modest beginnings of thirty years ago. From generating units of less than 50 kilowatts we have now come to 20,000-kilowatt machines and still larger units will doubtless be developed. Of the economies resulting from generating on a large scale and from concentrating electrical supply in huge systems fully ninety per cent has been realized by the consumers in reduced rates.

A modern large central station generates energy with a coal consumption per horsepower-hour about half that of the small scattered plants, including steam locomotives. The central station is thus a most marked factor in conserving our fuel resources. Moreover, it eliminates entirely the smoke, soot and other nuisances of the many small plants.

Central-station supply means the elimination of needless duplication of small, inefficient generating equipment. By reason of its diversified service it can provide reserve capacity that would have to be duplicated many times if left to isolated plants. The fixed charges in its generating costs are therefore also relatively very low. Thus the central station can sell to the factory or building owner at a lower price than it costs him to develop the energy in his own plant. There is no more reason for operating isolated electric plants than there is in operating isolated gas plants. The latter was done on a small scale many years ago, but is left entirely to the large gas companies now. So will the economy and reliability of central-station service ultimately replace isolated electric plants.

The replacement of isolated plants is being extended even to those formerly operated by large electric-railway companies. In the large cities each railway company and system had its own power plant, much of whose equipment was idle during most of the day. Now it is being realized that a large central station is peculiarly adapted to supply the power requirements of not only each of the surface-railway companies, but of the elevated and subway lines as well. In fact, co-ordination of the distribution network of the various lines would also release a vast investment in copper feeders.

Electrification of trunk-railroad terminals in large cities is bound to come for reasons of economy, if no other. In bringing it about, a very material saving in the necessary investment will be realized through the employment of central-station service, thus avoiding the cost of new power stations. In conclusion, the complete electrification of our cities from central generating sources is not the dream of a remote period that it seems to be.

Commission to Study Resuscitation from Electrical Shock Formed.

For some time efforts have been made to form a commission of medical and engineering experts to study and report on the best methods to be employed in resuscitation from electrical shock, and under the direction of W. W. Freeman, then president of the National Electric Light Association, early in the year steps were taken to get representatives of the medical and engineering professions, as well as representatives of the Government, to take up the matter in some definite way. After several meetings and formal discussions it was decided to leave the formation of a committee or commission to the American Medical Association, and subjoined are the names of the members of the commission, selected by the American Medical Association:

Dr. W. B. Cannon, chairman, Department of Physiology, Harvard Medical School, Boston, Mass.

Nominated by the American Medical Association: Dr. Yandell Henderson, Department of Physiology, Yale University, New Haven, Conn.; Dr. George W. Crile, 214 Osborn Building, Cleveland, Ohio; Dr. S. J. Meltzer, Rockefeller Institute, New York City.

Nominated by the National Electric Light Association: Dr. Edward A. Spitzka, Professor of Anatomy, Jefferson Medical College, Philadelphia, Pa.; W. C. L. Eglin, Philadelphia Electric Company, Philadelphia, Pa.

Nominated by the American Institute of Electrical Engineers: Prof. Elihu Thomson, ex-president of the American Institute of Electrical Engineers, Lynn, Mass.; Dr. Arthur E. Kennelly, Harvard University, Cambridge, Mass.; W. D. Weaver, secretary, editor *Electrical World*, 239 West Thirty-ninth Street, New York City.

A conference has held on December 16 by the president and secretary of the commission, and some preliminary work was mapped out. These steps will be followed up by an early meeting of the full commission, probably in New York in January, after which the plans adopted for the investigation will be vigorously pushed. It is felt that the much-needed revision of rules and practice in regard to this highly important subject will now be taken up under the best auspices and that authoritative conclusions will be reached.

The National Electric Light Association is to meet all expenses incurred, and will enjoy the full co-operation of the National Bureau of Standards, which has volunteered to undertake the distribution of the findings of the Commission to the public.

Proposed Changes in the Patent System.

The meeting of the Schenectady section of the American Institute of Electrical Engineers to be held on the evening of January 2 will be devoted to a paper on the subject of "Some Proposed Changes in the Patent System," by Albert G. Davis, managing attorney of the Patent Department of the General Electric Company.

Victoria Falls Power Company Building Fourth Station.

The Victoria Falls & Transvaal Power Company is erecting at Vereeniging, in the Transvaal, its fourth generating station. The initial equipment for this plant consists of four 9,600-kilowatt turbo-generators that are being furnished by the Allgemeine Elektricitäts Gesellschaft, of Berlin, Germany.

Growth of the Coal Production.

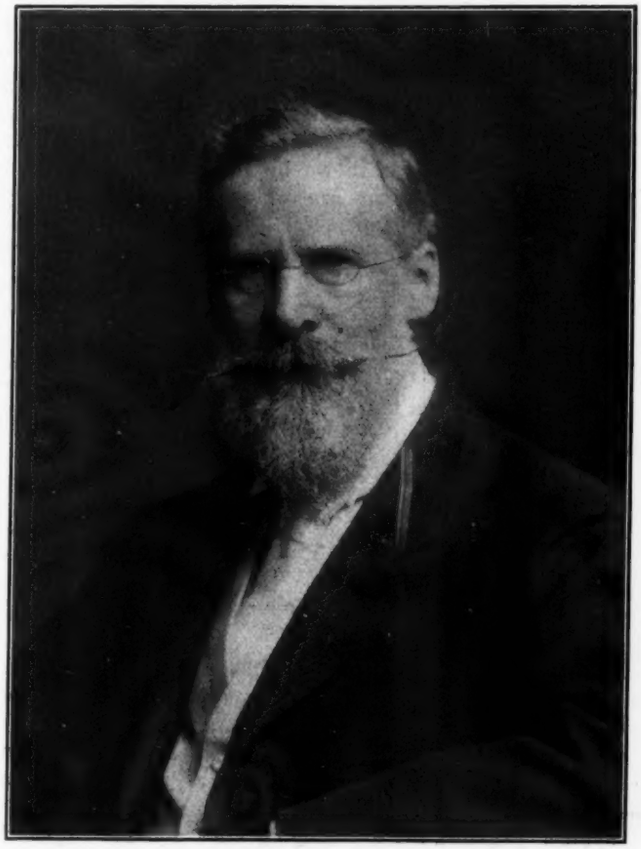
The amount of coal mined in the United States in 1910, according to figures of the United States Geological Survey, was greater by 10,000,000 tons than the total tonnage which had been mined up to the close of the year 1871.

Sir William Crookes.

Many of the basic principles underlying our present considerations of electrical phenomena have come to us through the brilliant research and painstaking attack upon inscrutable problems by the chemist. One of the most profound thinkers of the times, educated as a chemist and contributing in a remarkable way to our knowledge of electrical phenomena, is Sir William Crookes, inventor of the radiometer, the Crookes tube, the discoverer of thallium, and writer and lecturer upon many deeply scientific subjects.

Sir William Crookes was born June 17, 1832. He was trained from his youth as a chemist, attending and graduating from the Royal College of Chemistry. From 1851 to 1854 he was assistant to Dr. Hoffman at the Royal College, and in 1854 was appointed superintendent of the Meteorological department of Radcliffe Observatory, Oxford. In 1855 he became professor of chemistry at the Training College at Chester. In 1859 he founded the *Chemical News*, and in 1861 made his discovery regarding thallium. In 1864 he became editor of the Quarterly Journal of Science. In 1875 he was awarded the Royal Medal and he was Bakerian lecturer in 1878, 1879 and 1883. In 1880 the French Academy of Sciences bestowed upon him an extraordinary prize of 3,000 francs and a gold medal for his discoveries in radiant matter and molecular physics. In 1881 he was appointed juror at the Paris International Exposition of Electricity. In 1885 he received the Ferguson Medal of the Society of Arts. In 1886 he was made president of the Chemical Section of the British Association for the Advancement of Science. He was president of the Chemical Society of Great Britain in 1888 and 1889, and was recipient of the Davy Medal of the Royal Society in 1888. He was elected president of the Institution of Electrical Engineers of Great Britain in 1891, and was knighted in 1897. In 1898 he was elected president of the British Association for the Advancement of Science. He received the Albert Medal of the Society of Arts in 1899, the Copley Medal award in 1904, and he was given the Order of Merit in 1910.

He has been a prolific contributor to the scientific press of this and other countries, many of his works being classics in the subjects of which they treat. He has translated a number of important treatises from the German and French. His experimental work on vacuum tube lighting and phenomena opened up great avenues of opportunity for the perfection of incandescent lighting and led the way to the discovery of the X-ray, while his theorizing and experimentation in the realm of physics have established considerable of the prevailing theories respecting the constitution of matter and the nature of electricity.



SIR WILLIAM CROOKES,
Inventor of the Crookes Ink, Scientist and Chemist.

Underground Station Lighting With Tungsten Lamps.

The underground stations of the Central London Railway, London, Eng., are now lighted by means of 100-candlepower tungsten lamps equipped with Holophane reflectors. These replace the arc lamps formerly in use and give a much more uniform illumination that averages 4.5 foot-candles on a plane four feet above the platform. Despite this improvement the energy consumption is only about one-fourth what it formerly was.

Hydroelectric Power Expansion in Massachusetts.

Important changes in the electric power situation in central Massachusetts are foreshadowed by the developments now being carried forward in the Shelburne Falls district by the New England Power Company. The construction of four stations on the Deerfield River, the building of a 2,500,000,000-cubic feet reservoir near the headwaters of the stream in Vermont and the establishment of a 66,000-volt tie line between the South Vernon plant of the Connecticut River Transmission Company and the affiliated New England system mark the inauguration later of a service extending from the New York line to within forty miles of Boston. The operation of the Boston & Maine train service through the electrified Hoosac tunnel by current derived from the Deerfield plants and the readjustment of the present Zylonite turbine station as a steam auxiliary are also features of the development.

Until within the last few years Massachusetts has had little opportunity to enjoy the benefits of transmitted water power, but a decided change has lately come about in the central section of the State. For the most part the local lighting and small power service in this district have been handled by very moderate-sized steam plants, and the electric railways have in the main continued to produce their own electricity, chiefly on the ground of reliability. With the articulation of two large hydroelectric systems and increased opportunity for the energy supply of power from plants connected on reciprocal contractual arrangements the character and low cost of service will attract a wider range of users.

Joint Meeting of Lighting Societies in Chicago.

At the joint meeting of the Car Lighting Club and the Chicago Section of the Illuminating Engineering Society, December 20, C. W. Bender of the National Electric Lamp Association spoke on the drawn-wire Mazda lamp. He took up not only the method of manufacture, but the methods of figuring on the rating of the lamp. A number of valuable comparisons were also made with pressed-filament lamps.

Regarding the tensile strength of the filament, he stated that at the beginning, the tensile strength per square inch was about as follows:

Lamp Wattage.	Cross Section, Sq. Inches.	Strength, lbs.
100	.00290	451,000
60	.00207	499,000
40	.00153	574,000
25	.00118	737,000

Another interesting point in connection with the tensile strength of the drawn-wire filament was that this is often greater at the end of the lamp life than is found in a new molded-filament lamp.

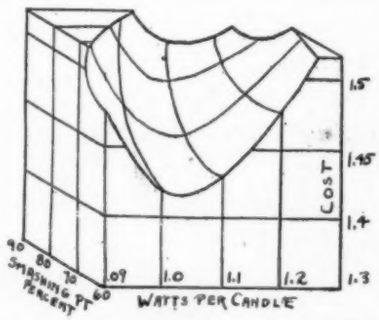
A noteworthy feature in regard to the forty-watt lamp which was described is that fifty-eight per cent of the initial installation is still burning. The first trial showed a life of 2,100 hours. The average life, counting those which were stolen or maliciously broken, was 984 hours. Leaving these destroyed and stolen lamps out of consideration the life is 1,452 hours.

The method of arriving at the proper efficiency of the lamp was also taken up, and a curve plotted between watts per candle and cost was shown. This was obtained by adding a curve of the cost of replacement and a curve showing cost of energy. A curve of total cost is the result. Of course the energy cost per candlepower plotted against the watts per candlepower gives a straight line.

In consideration of renewal cost, we may start by supposing a case where the lamp burns at three watts per candlepower. The Mazda lamp under such conditions would last indefinitely. At two watts per candlepower the life would be much shorter. The renewal expense per candle-hour would increase considerably more at one watt per candlepower. Below this point the curve would rise steeply. Adding the ordinates of these two curves a third curve results which represents the total renewal cost for a certain definite smashing point.

Suppose that a number of these curves be drawn for smashing points between sixty and ninety per cent, then each curve will slightly differ from the preceding and succeeding curves. If these are taken at regular intervals and in a sufficient number we have a three-dimensional curve such as shown herewith. This model was made for forty-watt lamps with a list price of seventy cents and an energy rate of ten cents per kilowatt-hour. It will be seen from it that the minimum cost is much in favor of the higher efficiencies.

In discussion, Mr. Gilman spoke very favorably of the sixty-volt lamp in connection with train lighting where the head-end system is used. There is, of course, a considerable saving in wire, as against the thirty-volt lamps. The general favor with which this system is meeting is shown by the fact that sixty-volt lamps are to be installed on the Harriman, Northwestern and Northern Pacific lines. A discussion



COST CURVE FOR DIFFERENT LAMP-SMASHING POINTS.

of the loss of metal-filament lamps through theft was also brought up.

Following some discussion of the arc-light situation in Chicago's loop district a motion was made by Mr. Wray that a committee be appointed to protest against the low-hanging arc lamps being placed by the city. This committee, of which J. E. Cravath was made chairman, comprises in addition Messrs. Aldrich, Barrows, Gilman, Wray and Cravens.

Program for Byllesby Convention.

As previously announced in these columns, the fifth annual convention of H. M. Byllesby & Company and affiliated companies will be held in Chicago, January 2 to 5, inclusive. The meetings will be held in the Auditorium Hotel.

A tentative program has been given out which includes many excellent features. Among the papers of electrical interest to be presented are included the following: "Ways and Means of Building Up Profitable Business in Small Towns Where Investment Is Large," by H. E. Morton; "Points of Contact with the Public—What They Are and How They Should Be Handled," by W. H. Hodge; "The Accountant in Public-Service Corporations," by B. W. Lynch; "Co-operation Towards Better Relations and Increased Efficiency of Employees," by W. R. Molinard; "Present-Day Jurisdiction of State and Municipal Bodies Over Public-Service Corporations," by Isaac Milkewitch; "Our Appraisal Work During 1911," by Harold Almert; "New Business Methods," by E. L. Callahan; "The Attitude of the Manager Toward His New-Business Department," by Alex. F. Douglas.

The opening address will be delivered by H. M. Byllesby. George H. Harries, O. E. Osthoff, B. E. Sunny and T. C. Martin will also address the convention. The annual banquet will be held on the evening of January 5. It is expected that Thomas A. Edison will be present at this affair.

Electric Ore-Handling Plant for Cleveland.

An ore-handling plant at Cleveland will be constructed shortly for the Pennsylvania Railroad, which is to have sufficient capacity to handle the cargoes of two large lake carriers daily, or from 25,000 to 30,000 tons. Its four unloaders will have seventeen-ton buckets, the capacity of the weighing larry will be fifty tons and that of the receiving hopper sixty-five tons. In connection with the work, about forty-three acres of land will be reclaimed, giving a frontage on the lake of about 2,000 feet. The work includes a reinforced concrete dock about 1,000 feet long, the ore-handling equipment already mentioned, a 2,200-kilowatt power house, a haulage system for handling cars under the machines and a yard for the loaded and empty cars.

McKinley Traction Lines Approach Chicago.

The Illinois Traction System has opened its new line from Morris to Joliet, twenty-two miles in length. This brings the system within forty miles of Chicago.

The new hydroelectric station which the company has been building at Marseilles has been completed.

Hydroelectric Development of the Salt River Project.

The Roosevelt Dam and Power Plant, the Transmission Line, Switching Stations, and Pumps.

One of the most important country-wide movements which is now taking place is the effort upon the part of the governors of the western states to interest eastern capital and the peoples of the eastern part of the country in the possibilities of investment and homesteading in the far west. The decade the desert has been made to bloom in many places and a vast region has been opened up for purposes of cultivation.

The Reclamation Act, under which some of the most important projects of irrigation have been carried forward, was made law by the signature of

THE ROOSEVELT DAM SITE—"AS IT WAS IN THE BEGINNING."

great western country, for a long time deemed rich only in mineral resources, has, during recent years, shown almost extravagant possibilities in agriculture, and under intensive cultivation the yields per acre have been far beyond the expectations of the most sanguine. Irrigation of the arid lands of the West is reclaiming what was hitherto considered to be a practically worthless territory and in less than a

Theodore Roosevelt on June 17, 1902. In substance the Act provides that all moneys received from the sale and disposal of public lands in Arizona, California, Colorado, Idaho, Kansas, Montana, Nebraska, Nevada, New Mexico, North Dakota, Utah, Washington and Wyoming, beginning with the fiscal year ended June 30, 1901, including the surplus of fees and commissions in excess of allowances to registers and receivers, and excepting five per cent of these amounts which is set aside for educational and other purposes, be appropriated and used as a special fund in the treasury of the United States to be known as the "Reclamation Fund." This fund is to be used for the examination and surveying, and for the construction and maintenance of irrigation works, for the storage, diversion and development of waters, for the reclamation of arid and semi-arid lands in the states and territories above enumerated.

The lands so reclaimed are subject to homestead entry, and there is no charge for the land itself, but the settler must pay to the United States in not more than ten annual installments

without interest, his proportion according to the number of acres he owns of the amount expended by the United States in reclaiming the land.

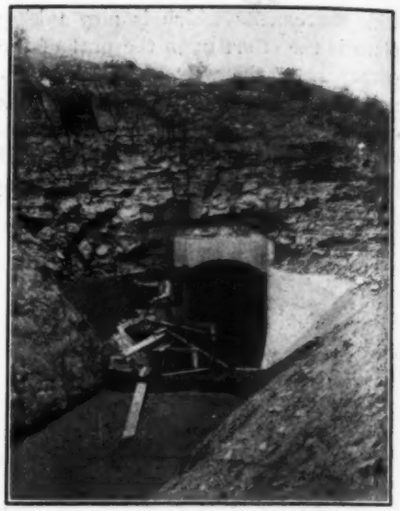
One of the most important of the projects inaugurated under the provisions of the Reclamation Act is that known as the Salt River Valley Project. This embraces the Roosevelt Dam and reservoir, a power canal, an electrical power development, and a transmission line; irrigation by gravity and pumping, and the supply of electrical energy from Government controlled transmission and distributing lines. This project was formally authorized by the Secretary of the Interior on March 12, 1903. The progress of the work was remarkable in many respects, and the Roosevelt Dam was dedicated by Theodore Roosevelt on March 25, 1911.

FLUME, SALT RIVER POWER CANAL.

The Salt River Valley lies in the south central part of Arizona, in Maricopa and Gila Counties. It is a fairly level plane sloping gently to the west and south. The average elevation of the irrigable area is 1,000 feet above sea level. The climate is generally good, the average temperature is sixty-nine degrees Fahrenheit, with extremes of twenty degrees to 120 degrees. The average annual rain for the irrigable area is seven inches. The month of heaviest rainfall in the valley is in August, followed by July, February, December, January, March, in the order named. This gives two distinct rainy seasons—one in summer and one in winter. All water supply for irrigation is furnished by the Salt and Verde Rivers, and the area of the drainage basin is approximately 6,260 and 6,000 square miles respectively. This supply fluctuates with the rainy and dry seasons, with a great volume running to waste at one time and far too inadequate a supply to afford any substantial irrigation at others.

The irrigable area covers about 260,000 acres, and in order to conserve every element of supply it was early realized that both gravity supply from storage reservoirs and a system of pumps must be installed. The pioneers in the valley have for a long time enjoyed the benefits of irrigation. The Apache and Pima Indians who have settled there are industrious and good farmers, and they have thrived alongside the privately owned canals which have been made possible through the splendid transmission lines and pumping plant of Dr. L. A. Chandler.

The largest feature of the Salt River Valley project and practically the only one contemplated at the beginning, was the Roosevelt Dam and reservoir. These are located in a rough, mountainous country practically inaccessible for moving freight. On account of these conditions the amount of preliminary work to be done before the main feature could be commenced was enormous. First of all there was available only a freight road from Globe, Arizona, forty miles distant on the closest railroad line. A road was constructed to a body of timber twenty-five to thirty miles from the dam site, and a sawmill purchased and erected, and nearly 3,000,000 feet of lumber was cut and distributed to the dam and various points where it was used. The saving to the project effected by the operations in lumbering was about $55,000. A telephone line was constructed connecting the various construction camps. This telephone line was later connected with Phoenix and Mesa in Arizona.



PORTAL OF TUNNEL ON POWER CANAL.

While Globe was closest to the dam site, Mesa had the advantage of two lines of railroad. The engineers consequently built a freight road through the mountain from Roosevelt to Mesa. This road is about sixty miles long. The cost of building this road was part-

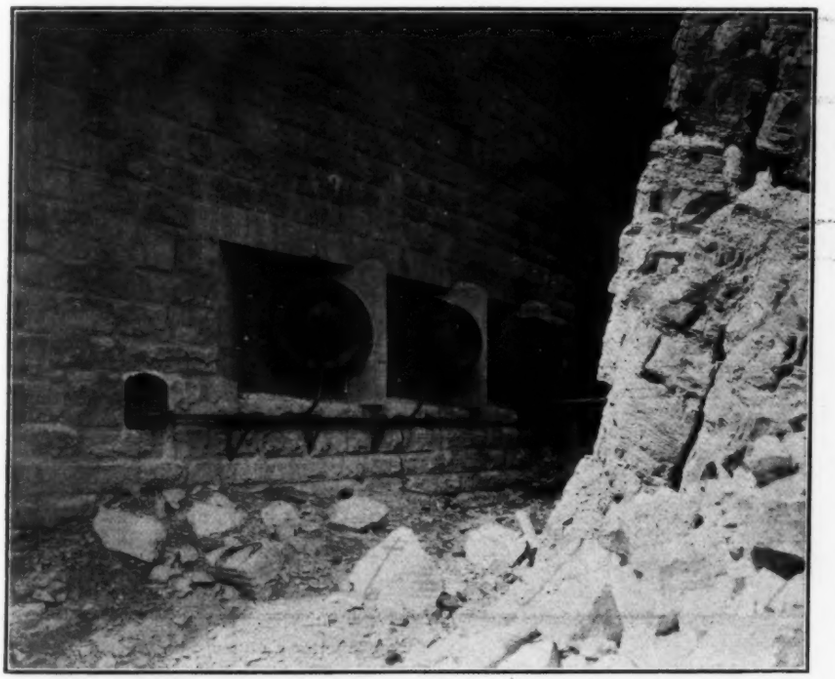
OPEN CUT, SALT RIVER POWER CANAL.

ly borne by the cities of Phoenix and Mesa, and the saving on freight on the material hauled over this route has amply justified the cost of its construction.

A cement mill was constructed to furnish cement for the building of the dam and other uses in connection therewith. Excavation for the foundation was started in November, 1903, and the mill first operated in June, 1905. The cement mill ran more or less continuously until August 1, 1910. The total output was 333,452 barrels of cement at a total cost of about $1,055,146. By comparison with the same number of barrels at $4.89 per barrel, the lowest bid obtained for delivery at Roosevelt, a saving of $599,883 to the Salt River project was shown.

The material for the sand crushers was secured adjacent to the dam site, as was also the sand and shale used in the sand crushing plant which was ready for operation early in 1906.

POWER-HOUSE END OF PENSTOCK.

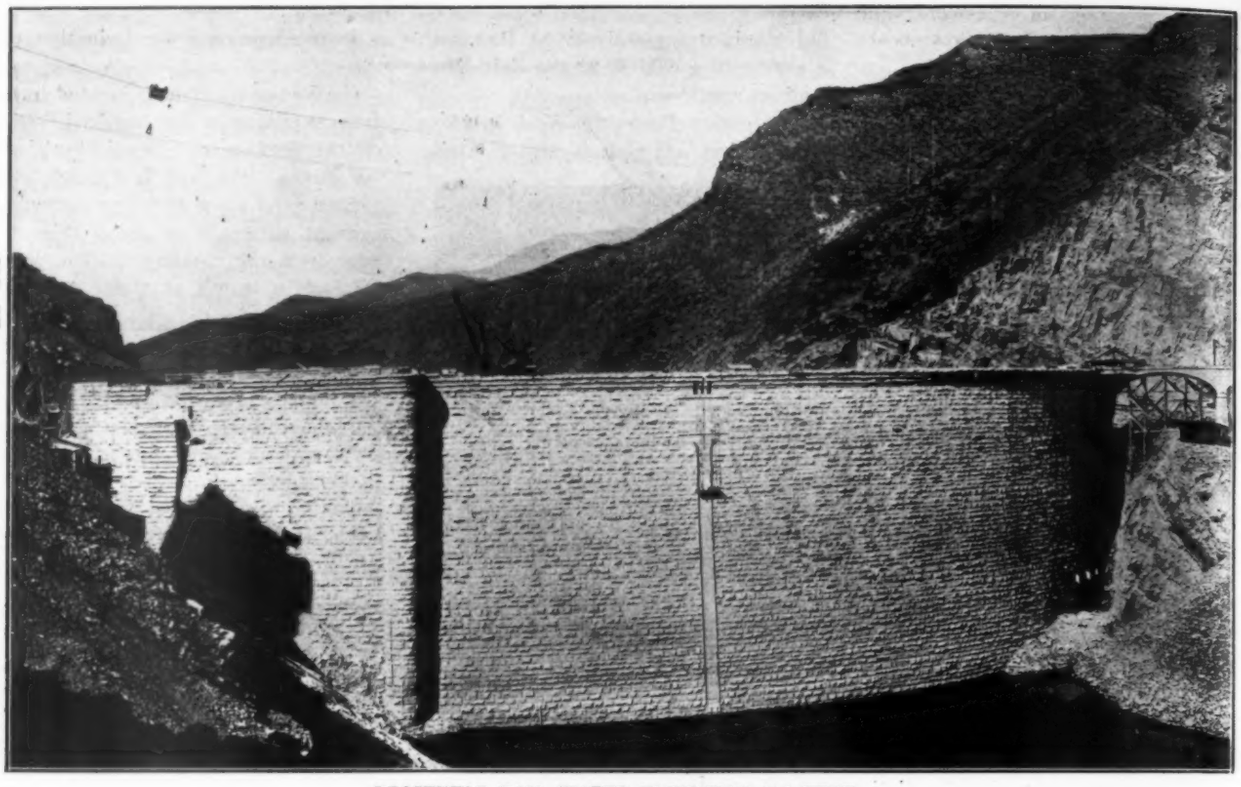


BALANCE VALVE AT THE MOUTH OF NORTH TUNNEL.

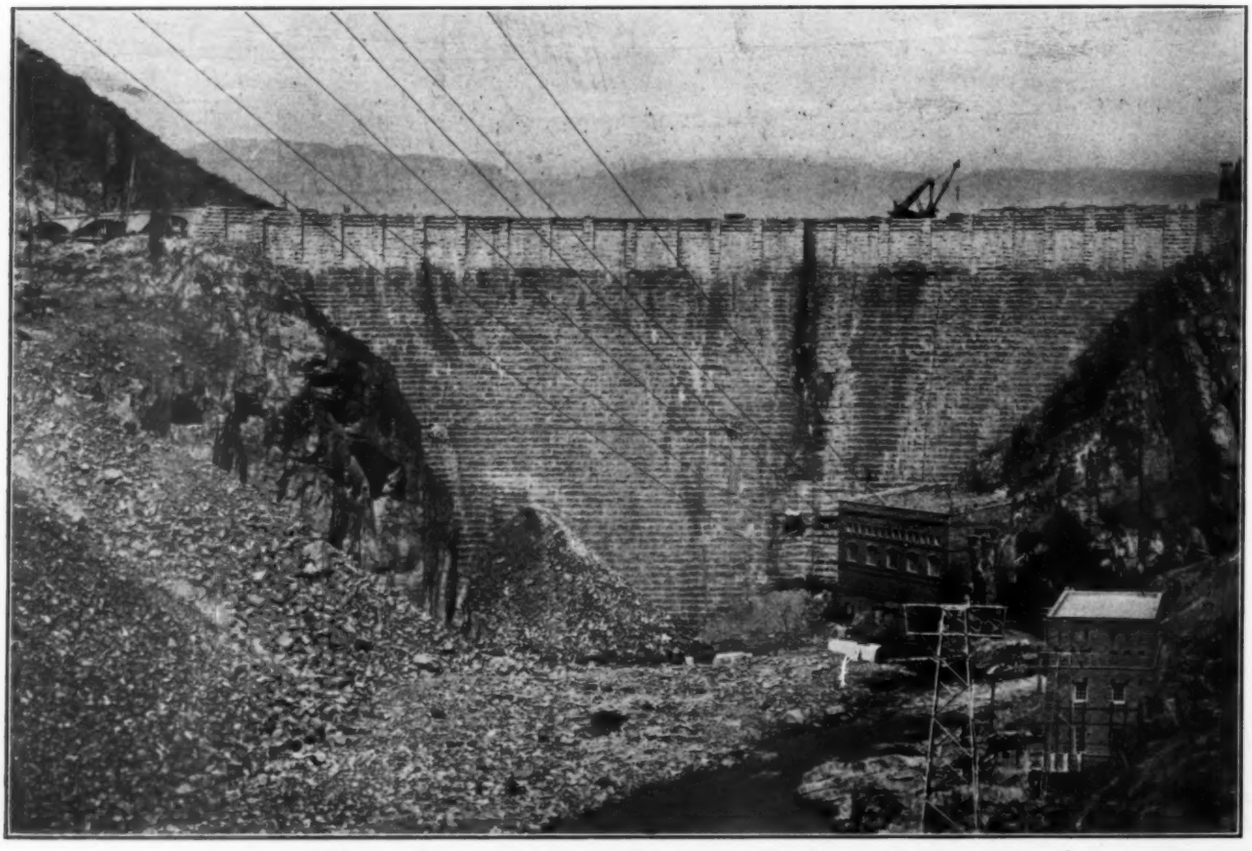
The power development at Roosevelt Dam consists of two separate hydraulic developments—one from a power canal constructed to furnish power for building the dam and ultimately for permanent power services, and the other for using the water from the reservoir as it is discharged for irrigation purposes.

The Roosevelt Dam is located in and across a canyon a few hundred feet below the confluence of Tonti Creek, with Salt River. The rock is a tough, close-grained sand stone and dips toward the river at an angle of about thirty degrees from the horizontal. The dam is 235 feet in length on the bottom and 1,080 feet in length on the top, including the spillways. The height from the lower foundation to the roadway is 280 feet, and the parapet wall is fourteen feet above this. The dam is built of broken range cyclopean rubble, thoroughly bonded in all directions. Two spillways are provided—one at either end of the dam, each 200 feet in length, with a crest elevation of 220 feet. On top of the dam there is a roadway twenty feet above the crests of the spillways. The parapet walls are three feet eight inches in height and are corbeled out so as to give a roadway fifteen feet eight inches in the clear between curbs. The dam at an elevation of 240 feet forms a quarter circle, from each end of which abutments are extended on the tangent. About thirty-five feet on these tangents are the curved faces of the wing walls and from thence there is a waste weir 200 feet long at each end. The spillways are cut into the solid rock around each end of the dam, and from these cuts was taken practically all the stone which went into the masonry. The roadway is carried across each spillway on three-arch reinforced concrete bridges.

PENSTOCK THROUGH DAM, SHOWING WHOLE LENGTH.



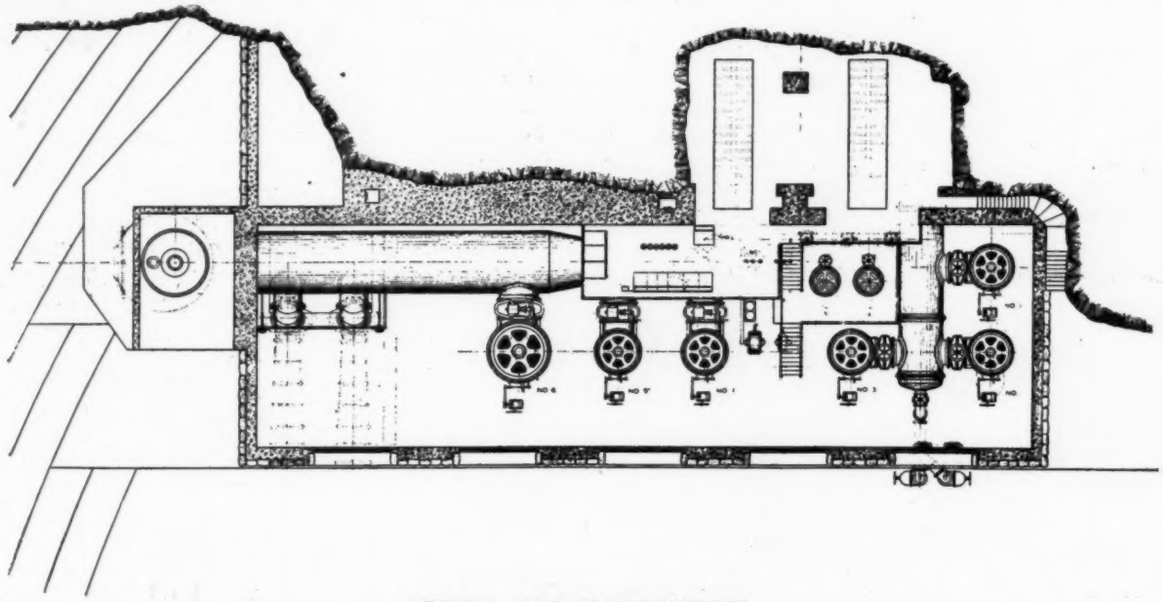
ROOSEVELT DAM—WATER ELEVATION 81.7 FEET.



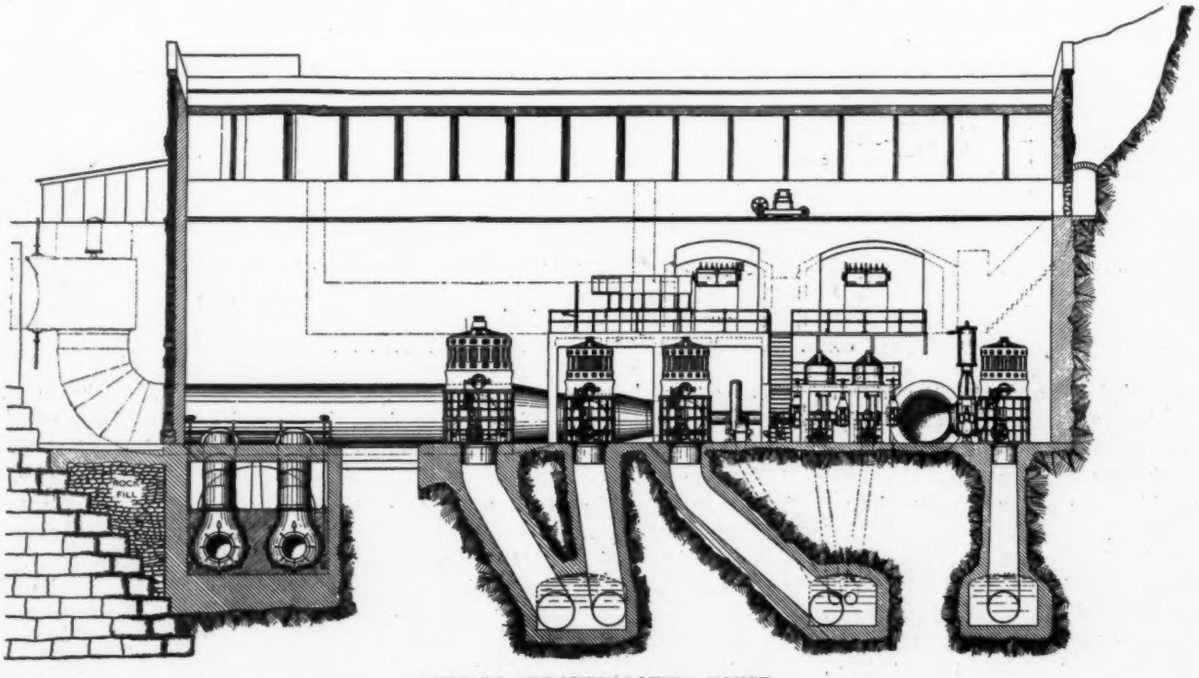
ROOSEVELT DAM, POWER HOUSE AND TRANSFORMER HOUSE.

The area of the reservoir created by the dam is 16,320 acres, with a capacity of 1,284,000 acre feet.

Water may be drawn from the reservoir by three passages. One, the sluicing tunnel built at an elevation so that the reservoir may be entirely emptied. The flow through the tunnel is regulated by two sets of gates, three gates in each set. These gates with the operating mechanism, weigh about 800,000 pounds, and are the larest gates ever constructed for the pressure of 100 pounds to the square inch. The second passage for water from the reservoir passes through the dam and consists of a riveted steel penstock ten feet in diameter, and the elevation of the penstock intake is seventy feet above the bottom of the reservoir. This penstock is equipped with a special emergency valve ten feet in diameter, and was built by the M. B. Pollock Company, of Youngstown, Ohio, and is connected with the water wheels of the permanent power house. The third passage of water from the reservoir is a tunnel some 260 feet in length through the rock on the other side of the river from the main sluicing tunnel. Water is taken through the dam into this tunnel by three lines of cast iron pipes each five feet in diameter, having an elevation at the intake end of 150 feet. The control of the water is effected by means of a five-foot balanced valve located at the intake end of each pipe. These valves are the invention of O. H. Ensign, chief electrical engineer of



GENERAL PLAN OF POWER HOUSE.



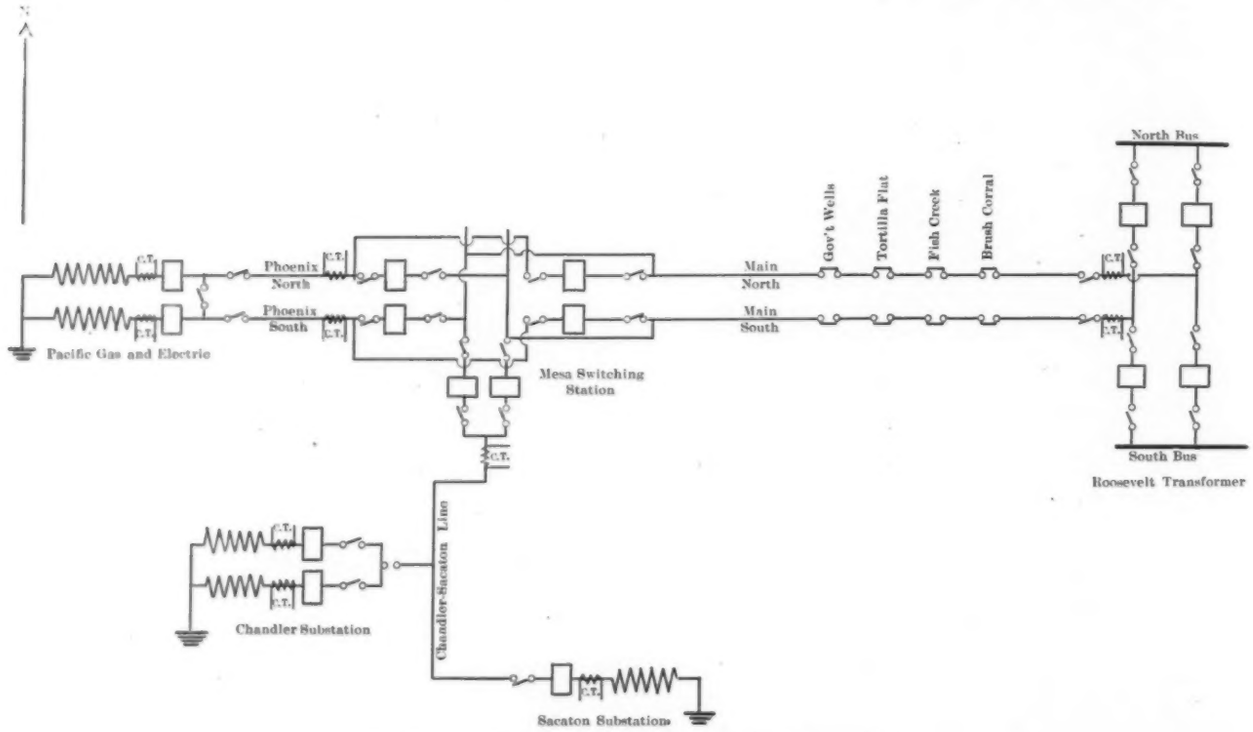
SECTION THROUGH POWER HOUSE.

the Reclamation Service. The circular opening is closed by a plunger, whose position and motion relative to the opening and direction of flow are the same as those of the plug in the bottom of an ordinary bath tub. Upstream from the plunger and operating it is a piston working in a casing. Water leaks slowly between the piston ring and the cylindrical casing until the chamber is filled. Then the greater area on that side of the piston acts to push the plunger to its seat with a rapidity dependent upon the ability of the rate of leakage to keep up the pressure. To open the valve the casing behind the piston is tapped by a small pipe which is led through to the downstream face of the dam. This small pipe when open discharges more water than can leak by the piston ring, the pressure behind the piston is reduced, and it is pushed open. The small pipe, of course, is discharging during the time the valve is desired open.

As was mentioned above, in order to have power for working operations and for lighting, a power canal was built to serve the first turbine and generator unit. The dam and intake for this canal are located on Salt River above the highest contour of the reservoir, about nineteen miles from Roosevelt. The dam consists of an overflow weir, built of boulders and concrete. The crest is 400 feet in length, and is about seven feet above the low-water level of the river. The power canal sweeps through the open country, following the course of the river, and is for the greater part an open cut cement-lined ditch, although in some places it takes the form of a tunnel and also a covered reinforced cement flume. The forbay and trash racks leading to the penstock skirt the edge of the high bluff on the east side of the reservoir, terminating just north of Roosevelt Dam.

The temporary power plant was located in a cave in the vertical cliff immediately below the dam at Roosevelt. This sheltered location gave protection to the apparatus during blasting, and when the permanent plant was installed the niche or cave was utilized for the housing of switching and controlling apparatus. The temporary plant consisted of a 1,300-horsepower Platt Iron Works water turbine connected to a 950-kilowatt, three-phase, twenty-five cycle, 2,300-volt generator made by the Bullock Electric Company.

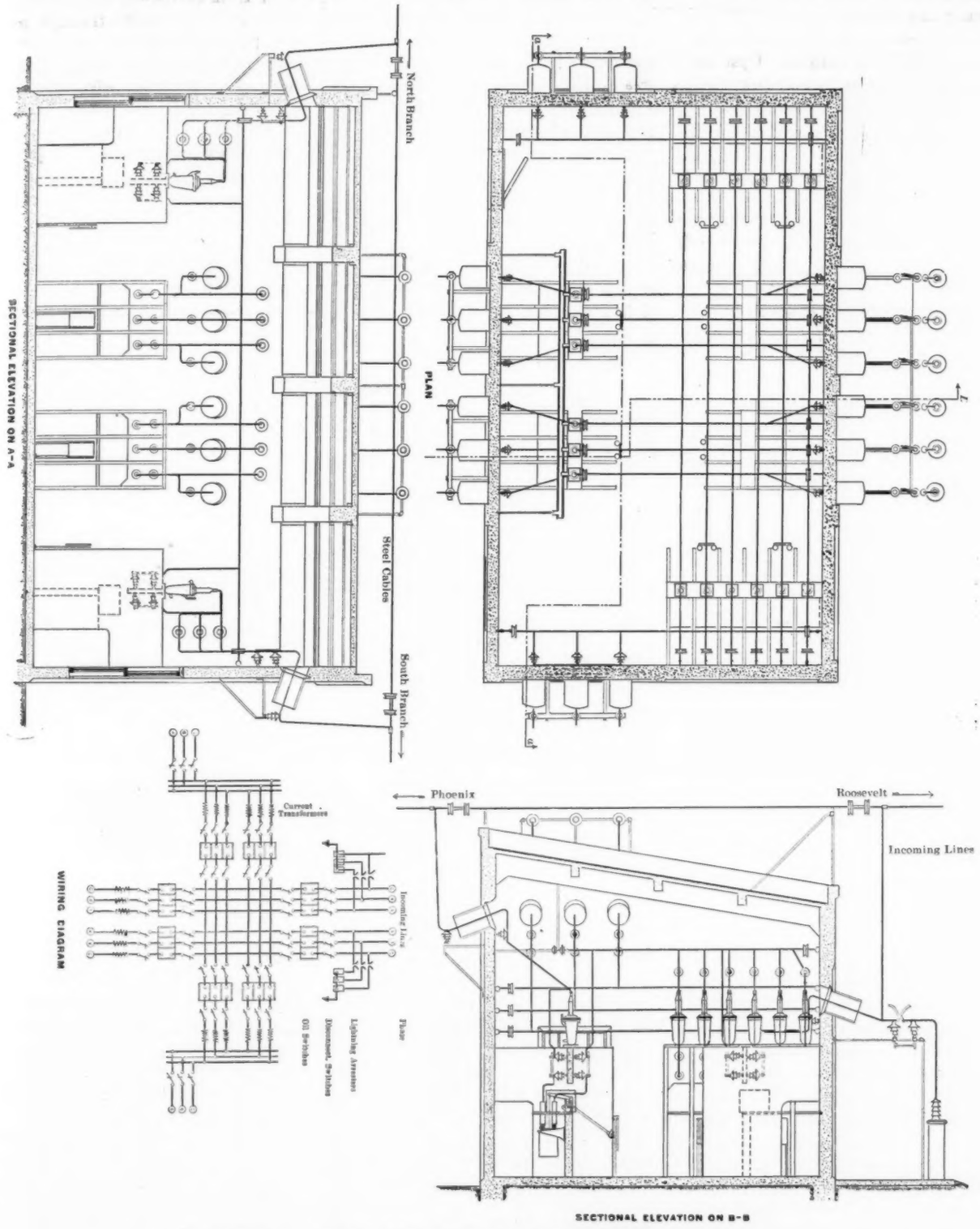
The permanent power plant is located at the foot of the dam and is built into the vertical cliff. The building is on a solid rock foundation, and the draft tubes and tail-race are built in solid rock. Two penstocks enter the building, one from the power canal, and the other through the dam. The water from the power canal is brought to three of the units through an inclined tunnel lined half way down with concrete only; the balance of the way the concrete is lined with steel plate. A seven-foot penstock extends from the lower end of the tunnel connecting with the three 1,800-horsepower full gate or vertical Smith water turbines driving 950-kilowatt, General Electric generators. The ten-foot penstock through the dam will ultimately serve three units, one of these 2,000 kilowatts and two of 1,200 kilowatts capacity. The generators supply twenty-five cycle, three-phase current, at 2,300 volts. The units served by the power canal will have a constant static head of 226 feet, while the units served by the penstock through the dam will operate under a variable head, dependent upon the height of water in the reservoir. They are designated to give maximum efficiency at a head of 160 feet, and they will be controlled to operate at heads varying from ninety to 220 feet. S. Morgan Smith water wheels drive the two 100-kilowatt exciter generators, and two Pelton wheels drive pressure pumps for the governor oil system. Lombard governors are attached to the large units and the two small exciter



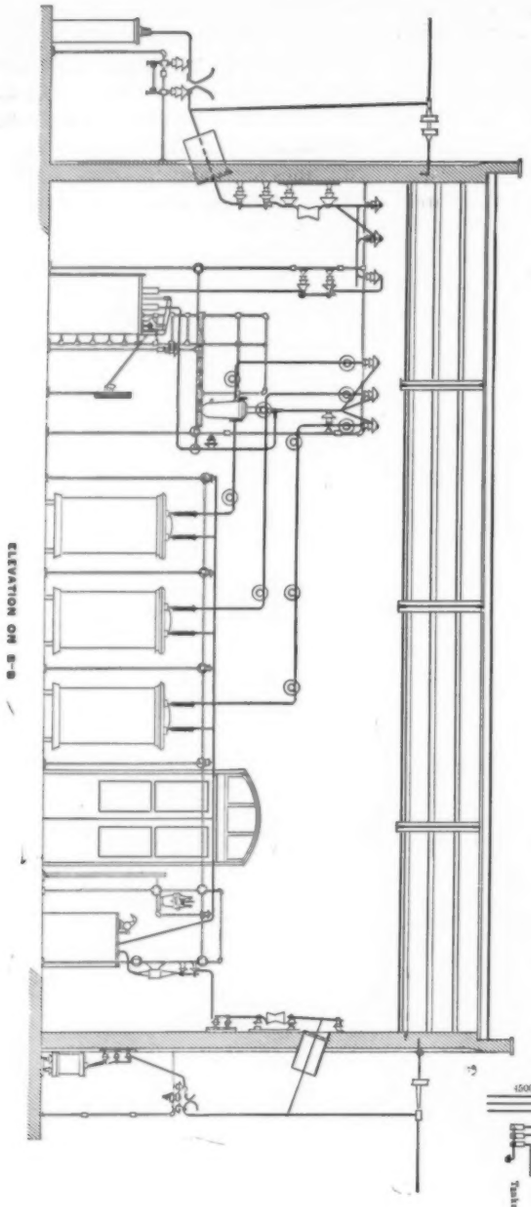
GENERAL WIRING DIAGRAM OF 45,000-VOLT SYSTEM.

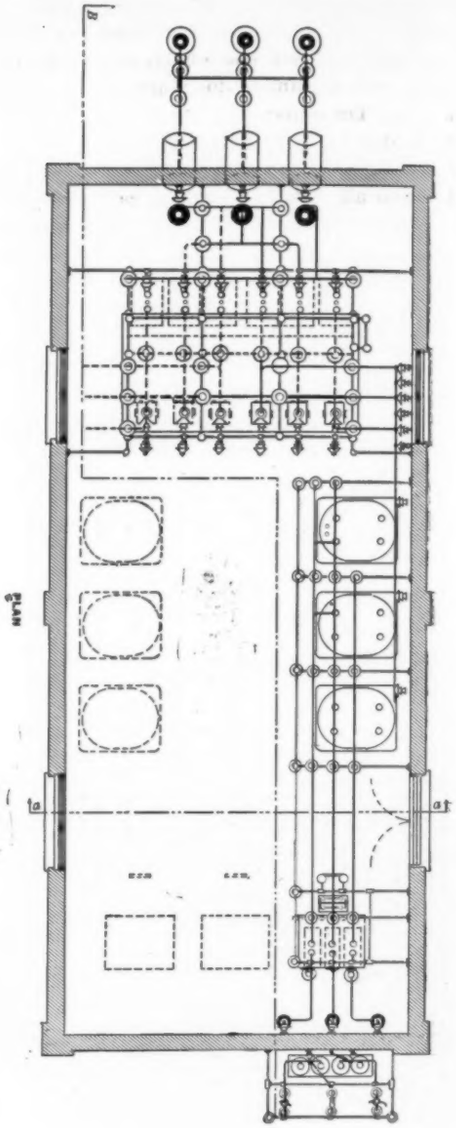
wheels are equipped with Woodward governors.

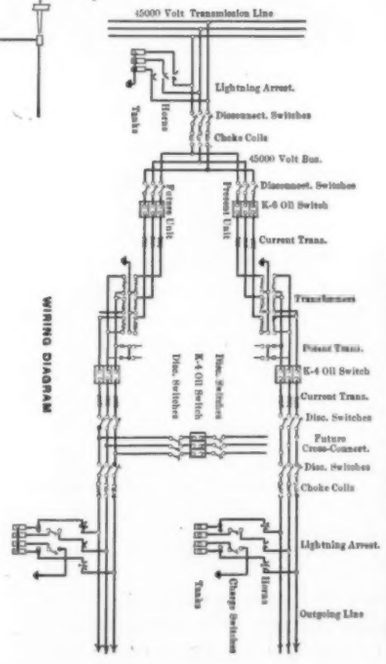
In the niche where the temporary power plant had been installed, back of the main power house, the 2,300-volt bus-bars and switches are located. There is a complete double bus-bar switchboard, with selector switches for both generators and transformers. The generator bus-bars are carried upon insulators supported upon brackets overhead, and the lead-covered cables from the generators to the bus-bars are equipped with Davis station terminals at both ends. There are two sections of switch cells, each bank being twenty-four feet long. The switches are mounted upon slate panels, housed in

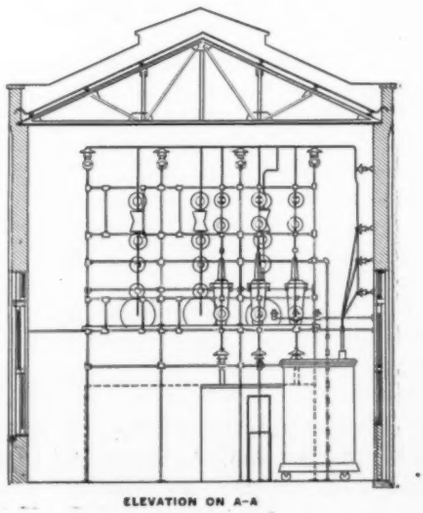


LAYOUT OF BRANCH SWITCHING STATIONS FOR 45,000-VOLT LINES.









TYPICAL SUBSTATION LAYOUT, HYDROELECTRIC DEVELOPMENT OF THE SALT RIVER PROJECT.

concrete compartments, sixteen inches wide. The concrete barriers between cells are four inches thick. Each cell is covered with a transite door, hinged at the top. The separate circuits are protected by disconnecting switches on either side of the solenoid-operated oil switches and all outgoing cable is carried to a wire tower upon the roof of the power house. On a gallery upon the level of the switch-room and overhanging the main power plant, are placed all the controlling apparatus. The six-panel General Electric benchboard serves the six generators, the primary and secondary connections of the six banks of transformers, and the two out-going 45,000-volt lines. The copper cables are carried in a long span from the wire tower to the transformer house, the north wall of the latter being of special construction figured to take this strain. The transformer house is a three-story building, the first floor containing the transformers and accessory repair and maintenance supplies, the second floor the double bus-bar and disconnecting switches, and the third floor the solenoid-operated oil switches, and outgoing line accessories. There are six groups of Wagner water-cooled transformers, transforming from 2,300 volts delta to 45,000 volts Y, the voltage of the transmission line. These transformers have a nominal capacity of 350 kilovolt-amperes, and were built according to the specifications of the Reclamation Service. Owing to the excessive temperature sometimes attained in this locality, the temperature requirements were rather unusual. These transformers have shown such good regulation and low heating characteristics that they may be operated continuously at nearly double their rated capacity without exceeding the temperature limits of the American Institute of Electrical Engineers' Standardization Rules.

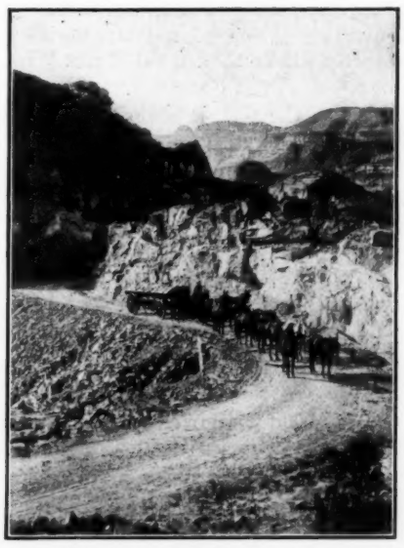
INTAKE ON SOUTH SIDE OF GRANITE REEF DAM.

125-volt exciter and station lighting six-panel switchboard is mounted next to the benchboard upon an angle-iron frame. The rheostat control wheels are mounted upon pedestals in front of the benchboard. The field rheostats are hung underneath the switchboard gallery. All remote-control apparatus for handling the various valves controlling the sluicing and water intake is controlled from this gallery.

The transformers and high-tension switches are located in a separate building about 600 feet from the power plant. The building is on solid rock foundation, built in the rocky gorge of the river. As the spillway from the power plant comes between the power house and the transformer house, the

The first floor of the transformer house is served by a large repair pit, and any transformer may be wheeled to the pits. The transformers rest upon large castors, are in fire-proof compartments, and each three-phase group is isolated by concrete barrier walls. Switches and bus-bars are inclosed in concrete cells, the busses being carried on line insulators. The incoming 2,300-volt lines are equipped with multigap lightning arresters. The two 45,000-volt lines are handled by motor-operated oil switches, passing from these to the choke-coils, thence to twenty-four-inch vitrified tile pipes direct to the first tower of the transmission line. The out-going lines are equipped with General Electric aluminum cell lightning arresters, mounted outdoors, the wiring for the arresters being carried on an iron pipe framework.

The transmission line consists of six 83,000 circular mill, six-strand, hemp core, hard-drawn copper wires supported upon fourteen-inch insulators having a flashover test of 165,000 volts dry. The line is supported on steel towers with the lowest wire at an average elevation of thirty feet from the ground in the mountains, and a limiting distance of thirty feet from the lowest wire to the ground in the valley. The average span is 360 feet in the mountains on account of the rough country, and 400 feet in the valley. The line is sixty-five miles long, reaching to Phoenix, Ariz., the largest town on the project. Forty miles from the power house a branch line is tapped off from a four-way switching station near the town of Mesa, running south for twenty miles and terminating in the substation at the Pima Indian Reservation. There is also about ten miles south of the main line another substa-



GOVERNMENT FREIGHTING OUTFIT ON FISH CREEK HILL EN ROUTE TO ROOSEVELT D.M.

tion for general irrigation pumping. In addition to supplying power for irrigation purposes, the main transmission line delivers power to the Phoenix substation of the Pacific Gas & Electric Company.

On the way from the Roosevelt Power Station to the main switching station the line passes through disconnecting switches at Brush Coral, Fish Creek, Tortilla Flat, and Government Wells.

The wires are spaced at the angles of a four-foot equilateral triangle. Both circuits are carried on the same towers. One circuit is transposed one-third of a spiral every two miles, and the other every four miles. At four points along the line the towers are fitted up so that by taking out a clamp the line may be opened for testing and working. From Roosevelt to the Highland Canal the wires are carried on rectangular angle-iron braced, galvanized steel towers made by the United States Wind Engine & Pump Company. From the Highland Canal to Phoenix the wires are carried on steel poles of the standard "Tripartite" construction made by the Franklin Steel Company, of Franklin, Pa.

On the towers there are four wires on the upper cross-arms, and two on the lower. The cross-arms are made of channel iron. The towers on straight way sections of the line are single braced. On the steel poles there are four wires on the lower cross-arm, and two on the upper. The cross-arms are made of U-bar section similar to the ribs of the pole and have diagonal braces and vertical struts between the two cross-arms to brace them. The towers in the section from Roosevelt to Goldfield are mounted on concrete bases or anchored in the solid rock. There are 418 towers and sixty-seven are double-braced, and the balance single-braced. In the section from Goldfield to Highland Canal there are 192 towers set on anchor plates, about two feet in diameter, buried from four to five feet in the ground.

Tripartite poles are used on the sections from the Mesa switching station to the Sacaton Station, and for the Chandler-Sacaton line to the Chandler Station. The Tripartite poles are all practically thirty feet high, set in concrete one-tenth of their length. The section running from the Eastern Canal to Phoenix is also carried on the standard Tripartite poles.

In stringing the wire on the level sections of the line in the valley it was drawn from the reels up over rollers on the towers, and then pulled up to tension by horses. In the mountainous section the wire was drawn in by means of a hoist mounted on a wagon, which carried two miles of half-inch steel messenger wire. The messenger wire was carried from the hoist drum to the reels two miles away by mules, and then the wire was pulled through. The messenger cable was then returned and the process repeated with each of the six wires. In this way the heavy transmission wires suffered no abrasion whatever in stringing through the rough country.

The three-part Thomas insulators shipped knocked down were assembled in the field and the pins cemented in by means of a special frame moved along with the stringing gang. The wire was tied to the insulators by two pieces of cable and special brass clamps.

Since the completion of the transmission line, but little interruption has developed. At the beginning of service it was found that a number of short-circuits were caused at certain points by large hawks sitting on the towers and touching the wires with their wings or bodies. A guard was therefore designed, consisting of a cast-iron cluster clamped to the tower and holding pointed rods of 5/16-inch birch dowels spread so as to prevent the birds alighting. Since placing these the service has been improved.

The main switching station is one and one-half miles northeast of Mesa. This is a concrete building fifty-two feet long, thirty feet wide and twenty-six feet high. The branch line running south to the Gila River Indian Reservation leaves the main line at this point. This building contains the necessary switches to control the circuits on either side of the main system or the branch. The station is protected by General Electric aluminum cell lightning arresters. The lines are dead-ended at the station entrances on disc type insulators and pass through open tile bushings to a set of four switches. The entire wiring diagram is on the ring system which will enable both circuits to be crossed over or interchanged simultaneously.

THE COUNTRY THROUGH WHICH THE TRANSMISSION LINE IS BUILT.

About seven and one-half miles south of Mesa and one mile west of the branch line, substation No. 1 is located on the edge of an area about three and one-half miles wide that will be largely irrigated by water pumped from wells. This is the Chandler sub-station, and is a building of reinforced concrete fifty-four feet high by twenty-three feet wide and twenty-three feet high. It contains three transformers for changing the current from 45,000 to 10,000 volts. A secondary distributing line, which totals about ten miles in length, starts from this station and will distribute energy to pumping stations lo-

cated in the area above mentioned. Substation No. 2, the Sacaton substation, is located about twenty miles south of the switching station on an area that will be irrigated by pumping. It is similar in construction to substation No. 1, and contains three transformers stepping down from 45,000 to 10,000 volts. A secondary distributing line about ten miles in length starts from substation No. 2 for the distribution of energy at 10,000 volts to eleven pumping stations.

The pump houses are built of concrete square over the rims of the wells. The typical equipment consists of current transformers operating overload relays, 10,000-volt automatic, oil-switches, three-phase, oil-insulated, air-cooled transformers, and the single-panel switch-board. The vertical induction motor operates on 220 volts, starting taps being taken from the secondary of the transformer for starting the motors at half voltage. The switch panel is equipped with a tripie-pole, double-throw, knife switch and an ammeter. Pumps and motors are mounted on vertical shafts. The mechanism of the motor, pump and frame is mounted on I-beams, built into the concrete well casing. The motor can be unbolted and lifted out, and the frame and pump lifted out for examination. The pump house is served with an overhead I-beam, equipped with block and fall for lifting the heavy mechanism. The wells are sunk in single batteries and in drifts of two and three, the pump suction going to a common manifold where there is more than one well in the battery. The wells consist of a sixteen-inch California well-casing driven to a depth of 200 feet, a large portion of this depth consisting of coarse gravel. Around this is sunk a concrete caisson nine feet in diameter to a depth of from forty-five to fifty-five feet.

A telephone line has been constructed on the poles carrying the transmission line near Mesa to the Pacific Gas & Electric Company in Phoenix, and also on the branch running south from the switching station and connecting with the two substations.

The further development of this work contemplates the establishment of additional generating capacity at several locations along the valley of the Salt.

At Granite Reef, about twenty-five miles from Phoenix, a dam has been built at the head of the canal systems of the valley. This replaces a number of temporary brush and rock structures. It is designed as an overflow weir 1,000 feet in length and about twenty-six feet high. The water in the river is raised about twenty feet. The sluiceways at either end of the dam are closed by large gates, all of which are eight feet below the crest of the dam. It is expected that by introducing certain improvements in the northside canal system and abandoning some of the earlier Salt River Valley canals that it will be possible to take advantage of a fall of about 125 feet. All this is taken up in the old canal in a succession of small drops. If this were segregated at one point it is estimated that from 5,000 to 6,000 additional horsepower could be generated. The construction and equipment of a power house between the South and Consolidated Canals would secure an additional 3,000 horsepower, and a power house at the Arizona Falls on the Arizona Canal would be good for approximately 700 additional horsepower.

The work was designed and constructed under the direction of O. H. Ensign, chief electrical engineer; Louis C. Hill, supervising engineer; I. C. Harris, electrical superintendent, and Chester W. Smith, constructing engineer, to all of whom we are indebted for the information given in this description.

Philadelphia Section, Illuminating Engineering Society.

The regular monthly meeting of the Philadelphia Section of the Illuminating Engineering Society was held in the Assembly Hall of the Philadelphia Electric Building, on December 15. After dinner at Mosebach's Restaurant, an interesting display of illuminating appliances for use by the physician and surgeon was examined in the lecture hall and a number of manufacturers of these contrivances demonstrated them later in the evening.

The meeting was called to order at 8 p. m. by Joseph D. Israel, chairman, 139 members and visitors being present. Dr. W. M. L. Coplin, medical director of Jefferson Hospital and professor of pathology at Jefferson Medical College, spoke on "Institutional Lighting," with special reference to hospitals. Dr. Coplin has made a thorough study of the problem of correct and efficient illumination, especially of wards and operating rooms in hospitals, both here and abroad, and a great many new ideas in regard to what is required in hospital lighting were obtained from him. The subject was discussed by Dr. William Spitzka, Professor Hoadley, C. B. Reger, C. O. Bond, F. N. Morton, G. B. Muth, and others.

Nela Engineering Society Lectured on World Tour.

At the regular Thursday evening meeting of the Nela Engineering Society, of Cleveland, Ohio, on December 21, D. M. Gardner held the attention of those present by an exceptionally interesting and instructive subject—his 30,000-mile tour around the world. The lecture was profusely illustrated by over 200 lantern slides, most of which were made from photographs taken by Dr. Gardner and his wife in the course of their travels. The audience on its return to Broadway after it had in fancy made a complete circuit of the globe, moved to an adjoining room where there was on display a large and varied exhibit of curios collected by Dr. Gardner during his nine months' trip. From this point in the evening's program the meeting developed into one of sociability promoted largely by the presence of a goodly number of ladies, musical selections by the N. E. L. A. Glee Club and refreshments.

New York Electrical Contractors Plan Big Celebration.

The annual meeting of the Electrical Contractors' Association of New York City will be enlivened by the unusually complete entertainment program that has been arranged. Tuesday, January 16, will be the big day. At 4:30 p. m., there will be given an afternoon tea and reception at the Building Trades Club, 30 West Thirty-third Street. At 8 p. m., there will be a theater party at the Winter Garden, Broadway and Fiftieth Street. Then an automobile ride along the "Great White Way" to the Building Trades Club for supper, songs and stories. The price covering everything has been fixed at $5. The committee is as follows: James R. Strong, chairman; Charles L. Eidlitz, John Livingston, E. S. Keefer, George Weiderman, secretary.

There should be a steadily increasing demand for electric lighting, heating and cooking appliances at Lourenco Marquez, Portuguese East Africa, as a result of the efforts of the Delagoa Bay Development Corporation to popularize their use.

MEASUREMENT OF ELECTRICAL ENERGY BY RECORDING WATT-HOUR METERS.—II.

ROTATING-FIELD INDUCTION METERS.

BY JOSEPH B. BAKER.

The Columbia induction meter (Figs. 10, 11, 12) presents several interesting distinguishing features. It is a high-torque meter, and the ideal sought is to have not only a high ratio of torque to weight of the rotating element, but also to have a high torque per watt of energy consumed by the meter. The torque of 80 millimeter-grams, energy consumption of 3 watts, and 32 grams weight of rotating element figure out a torque per watt of energy consumption of 26.6 millimeter-grams and a ratio of torque to weight of 2.5. One revolution on a five-ampere, single-phase, 110-volt meter represents 1,000 watt-seconds.

On non-inductive loads this meter shows a slight tendency to run fast on very light loads—a desirable feature, since on light loads the torque is so small that any appreciable increase in friction would tend to slow down the meter. The overload characteristic (Fig. 13), with its straight line and slight slope, is noteworthy. For example, a residence with twenty-five lights rarely uses more than ten; but should the total load be connected at one time on some special occasion, a meter with good overload characteristics will still register accurately. On inductive loads, provided the series and potential fluxes are displaced exactly ninety degrees, the meter should be accurate on all power-factors. However, much depends on the accuracy of the initial adjustment, and if the phases should be slightly displaced and the meter is to be installed on a low-power-factor load, a more accurate adjustment can be obtained by means of the inductive-load compensator, consisting simply of a loop of resistance wire in series with the series coil, these two elements being shunted by the lag coil. The light-load adjustment consists of a metal shoe, sliding micrometer-wise on the potential core and actuated by a knurled screw, causing the potential flux to be deflected in one direction or the other and producing a direct or a counter torque respectively, thereby tending to accelerate or to retard the motion of the rotating element.

Among the advantages of the low-reluctance iron circuit of the shunt field of the Columbia meter are reduced wattage, reducing the all-day loss in this element of the meter (which is permanently connected across the line), and reduced sensitiveness to voltage variations, whereby meter error due to such variations is minimized and whereby also tendency to creep is minimized. Full-load adjustment, which is in some induction meters obtained by sliding the permanent magnets in or out so as to decrease or increase the lever arm of the resisting force on the disk, is accomplished in the Columbia meter by a light, soft-iron bridge-piece, which can be slid back and forth over the gap between the two magnets.

The position of the magnets in the separate compartment for each one of the terminal posts, so arranged that it is impossible accidentally to short-circuit the posts, as by the slipping of a screw-driver in making connections. The cover is of pressed aluminum, with a large glass window and a dust-proof gasket of felt. The base is of pressed steel of sufficient thickness to eliminate warpiug. Either ordinary or cyclometer-type dials are provided, geared high to reduce the effect of friction, and the driving connection is through an offset of an arm forwardly projecting from the worm-wheel shaft and engaging with the offset of a similar arm on the gear train. The cyclometer-type dial contains no springs to bring about an intermittent friction play, but is stated to operate as smoothly as

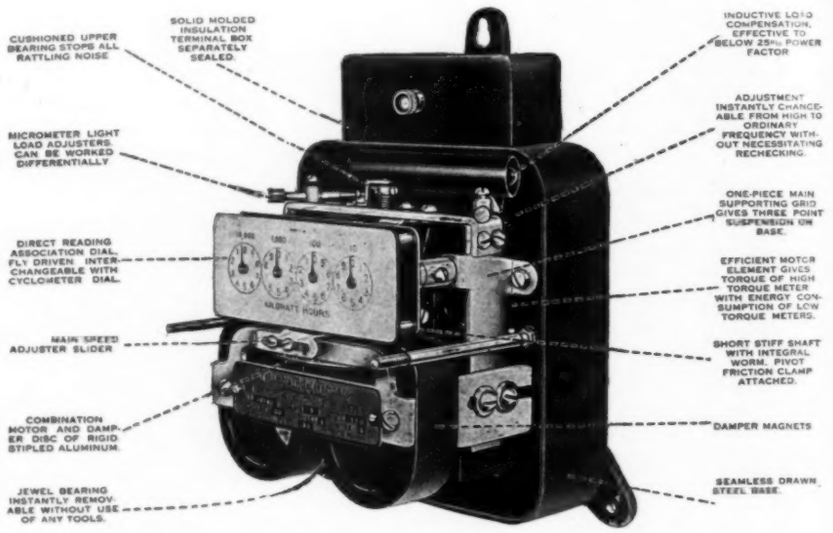

CUSHIONED UPPER BEARING STOPS ALL RATTLING NOISE
SOLID MOLDED INSULATION TERMINAL BOX SEPARATELY SEALED.
INDUCTIVE LOAD COMPENSATION, EFFECTIVE TO BELOW 25% POWER FACTOR
ADJUSTMENT INSTANTLY CHANGEABLE FROM HIGH TO ORDINARY FREQUENCY WITHOUT NECESSITATING RECHECKING.
MICROMETER LIGHT LOAD ADJUSTERS, CAN BE WORKED DIFFERENTIALLY
ONE-PIECE MAIN SUPPORTING GRID GIVES THREE POINT SUSPENSION ON BASE.
DIRECT READING ASSOCIATION DIAL, FLY DRIVEN, INTERCHANGEABLE WITH CYCLOMETER DIAL.
EFFICIENT MOTOR ELEMENT GIVES TORQUE OF HIGH TORQUE METER WITH ENERGY CONSUMPTION OF LOW TORQUE METERS.
MAIN SPEED ADJUSTER SLIDER
SHORT STIFF SHAFT WITH INTEGRAL WORM, PIVOT FRICTION CLAMP ATTACHED.
COMBINATION MOTOR AND DAMPER DISC OF RIGID STIPLED ALUMINUM.
DAMPER MAGNETS
JEWEL BEARING INSTANTLY REMOVABLE WITHOUT USE OF ANY TOOLS.
SEAMLESS DRAWN STEEL BASE.

FIG 10.—INTERIOR OF TYPE C COLUMBIA INDUCTION METER.

design of this meter is also noteworthy. With well-aged magnets mechanical jars will not cause weakening, and the important consideration is the proper shielding of the magnets from disturbance from the fluxes caused by heavy overloads or short-circuits. In the Columbia meter the two magnets are removed sufficiently far from the center of flux so that a temporary short-circuit will not affect them.

The following features of detail construction are also of interest. As in most induction meters, a separate terminal box is provided, obviating the necessity of exposing the meter mechanism in installing or removing the meter, and preventing entrance of dust or moisture into the meter compartment proper. In this meter the molded-insulation terminal block is made with a

though geared. To remove the dial necessitates the loosening of only two screws; this feature is important where it is desirable to re-set the dial, as in changing a meter from one installation to another. The magnets are removed by taking out four screws. Sapphire jewels are employed, and the mounting of same is of interest. The jewel is removed by shifting aside a phosphor-bronze leaf spring *A* (Fig. 14), allowing the jewel to drop into the hand held beneath it, no tools being required. This feature facilitates a quick inspection of the jewel without removing the meter, in case of trouble pointing to the jewel as the probable cause. The phosphor-bronze spring also efficiently cushions the jewel. The rotating element is removed by taking off the nut *B* (Fig. 14), which contains the jewel,

and then loosening the screw which fastens the top-bearing bracket. To remove the pivot it is only necessary to pull it out with pliers or tweezers, since the pivot is held by a simple friction fit—an obviously advantageous arrangement. The disk is stiffened by stippling, and the staff is short and thick and will not bend. The frame, of brass, has a three-point suspension, and the entire mechanism may be taken out of the case by the removal of three screws.

Influence of Wave Form on the Rate of Induction Meters.—The effect on the rate of induction meters of varying the wave form has been determined at the national Bureau of Standards.[4] Five 60-cycle single-phase induction meters, *viz.*, two Stanley magnetic-suspension-

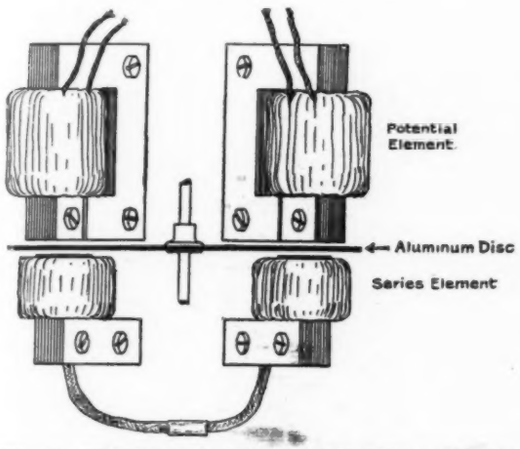


FIG. 11.—PROPELLING SYSTEM OF THE COLUMBIA INDUCTION METER.

type meters of 50 amperes capacity each, one Fort Wayne type K 50-ampere meter, one General Electric 25-ampere meter, and one Siemens and Halske 25-ampere meter, were tested at 110 volts, full load, unity power-factor.

The meters were tested with current of sine wave form and with a distorted wave, the distortion being produced by adding a harmonic of three times the frequency of the fundamental and varying both the amplitude and phase of the harmonic. This control of the wave form was obtained by means of a motor-generator set, consisting of a four-pole and a twelve-pole alternating-current generator and a direct-connected driving motor. The current from each generator was very nearly of sine wave form, and tests were made of the meters alternately with the fundamental only and with the harmonic added. The three different relative values and four different phases of the harmonic were employed. The three values of the harmonic were 10 per cent, 25 per cent and 50 per cent, respectively, of the value of the fundamental. By shifting the coupling between one of the generators and the driving motor 5, 10, and 15 degrees, the phase of the harmonic with reference to the fundamental was shifted 30, 60, and 90 degrees, respectively. Four combinations were thereby produced giving a peaked resultant wave, and by reversing the connections at the terminals of the generators of the harmonic four other combinations were produced giving a flat or dimpled wave.

The current, voltage, and power-factor, as well as the temperature and frequency, were maintained as nearly constant as possible during a set of runs. The standard wattmeter was of the dynamometer type and astatic, with very little metal in the region of the coils, with fixed coils of stranded wire wound on wooden spools, and with movable coils having very slight inductance. It was calibrated by direct currents, using two potentiometers to measure simultaneously the current and the voltage. The construction described provided every precaution to avoid errors due to eddy currents or wave form; so that the instrument when calibrated with direct current was then correct for alternating current.

The rate of the meters was determined by means of a chronograph and chronometer. The chronograph was also used to determine, very exactly, the frequency of the current, and the necessary (slight) correction was applied to the rate of each meter for the small departure of the frequency from 60. The runs averaged about three minutes each, a warming-up load being applied before making a series of runs on the meters. In order to obtain the effect of the varying wave form alone, errors due to changes in temperature, as well as other constant errors due to changing conditions, were eliminated by interspersing the tests upon distorted wave forms with tests using sine wave forms.

The maximum variation due to 25 per cent of harmonic was found to be, in the case of the Fort Wayne meter, a little less than one per cent—being greater with the peak than with the flat wave, but not varying much with the phase of the harmonic. On the other hand, the Stanley meters showed smaller errors due to the presence of the harmonic, but greater changes due to shifting the phase of the harmonic, both changing from slow to fast on the flat wave when the phases shifted. The General Electric meter ran faster for both peak and flat waves and at all phases than on a sine wave and was the only meter of the five which did so.

The effect of change of frequency on the rate of the meters was shown to be

FIG. 12.—COLUMBIA INDUCTION-TYPE TEST METER.

relatively small in all of the meters of American make. The curve presenting this effect on the Siemens & Halske meter, however, showed a variation of over six per cent between 55 cycles and 65 cycles.

In conclusion, the authors state: "These results show that with suitable precautions induction meters may be made to repeat their readings very accurately, so that precision methods may be applied in studying them. They also show that the variation due to wave form depends not only on the harmonics which are present and their magnitude, but also on their phases. The Bureau of Standards now has a generating set[5] which will give all the odd harmonics up to the fifteenth and any desired combination of them with the fundamental. The results given here show that for commercial purposes

4 "Influence of Wave Form on the Rate of Integrating Induction Meters," by E. B. Rosa, M. G. Lloyd, and C. E. Reid, Reprint No. 21 (from Bulletin No. 3, Bureau of Standards), 1906.

5 This machine, made by the General Electric Company, was installed in the Bureau in June, 1907.

all the meters so far studied may be considered accurate on any ordinary wave form where only the third harmonic enters appreciably, although two meters show variations of about three per cent when the harmonic amounts to as much as fifty per cent of the fundamental."

THE STANLEY DIFFERENTIAL MOTOR METER.

A new induction meter, known as the "differential motor meter" invented by William Stanley, operates on an entirely different principle from the ordinary rotating-field induction meter. For a complete account the reader is referred to an illustrated article entitled "A New Induction Watt-Hour Meter," by G. Faccioli, in the *Electrical World*, June 16, 1906, page 1266. It may be stated here, however, that the meter consists of two similar disks on the same vertical shaft, each disk being driven by the reaction of the eddy currents in it upon the fluxes which the eddy currents themselves set up in the gap of an iron "wing" inclosing the coil.

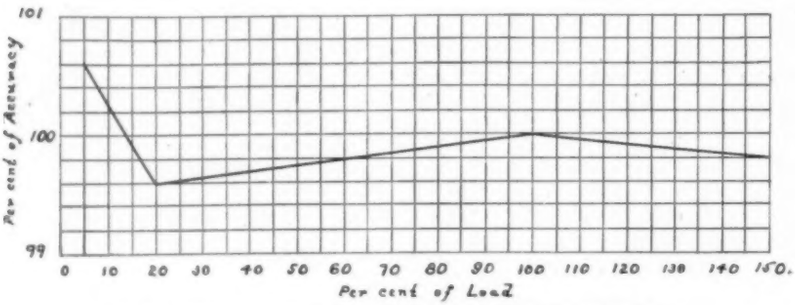


FIG. 13.—CHARACTERISTIC OF COLUMBIA INDUCTION METER.

Fig. 15 is a view of a model of the driving mechanism of this meter. In Fig. 18 is given a view of the actual meter, in which the torque is produced, not by phase-displaced fields, but by eddies in the disk, reacting dynamically upon the fluxes they themselves (the eddies) produce in the disk; and this torque is therefore proportional to the square of the eddies.

Each motor element has a single coil and gap, excited by a shunt and a series winding. Call the shunt and series windings of the upper motor A and B, respectively, and the same windings for the lower motor element A' and B', respectively. A and A', which are identical (generating a flux equal to a), are wound in the same direction and constitute the shunt winding of the meter; whereas B and B', also identical (each generating a flux equal to b), constitute the series winding of the meter but are wound in opposite directions. On non-inductive load, with the fluxes due to all four windings in phase, the total flux of the upper motor element is $a + b$, whereas the total flux of the lower motor element, owing to the opposed magnetomotive forces, is $a - b$. It follows that the torque of the upper motor element will be $(a+b)^2$, and that the torque of the lower motor element will be $(a-b)^2$; so that the resultant torque of the two disks fixed on the common shaft will be proportional to $(a+b)^2 - (a-b)^2 = 4ab$. That is, the resultant torque will be proportional to ab; the electromotive force times the current, or the power.

In the article referred to it is also demonstrated that the torque is proportional to true watts for operation of the meter on inductive load.

The complete meter shown in the illustration is accurately adjusted to read correctly for all power-factors and very wide variations of voltage and frequency. It is important to note that this meter does not rely on any of the phase-differing principles of Ferraris or Tesla. The writer is indebted to William Stanley for the photographs from which the views of this meter are reproduced.

COMMUTATOR METERS ON ALTERNATING-CURRENT CIRCUITS.

Meters of the commutator type may be used on alternating-current as well as direct-current services, since the field coils are in series with the load current, and the armature is energized proportionately to the electromotive force of the mains, so that the torque exerted on the armature is at any instant proportional to the product of the instantaneous values of the current and electromotive force.

As described at greater length below, commutator meters have been employed on alternating-current circuits, with or without "lagging" them to establish the appropriate phase relation between the series field and the armature; but even with such lagging, in the opinion of most meter experts, these meters can not compete with the induction meter. However, although central-station companies purchase induction meters as a rule, and not commutator meters, for use on their alternating-current circuits, some companies that have changed over from direct current to alternating current and that possess a stock of commutator meters, continue to utilize them by installing them on the new service.

Requirements for Commercial Operation.—The effectiveness and accuracy of commutator meters when installed on alternating-current circuits is increased by attention to certain details of maintenance on these meters. Thus, the tension of the brushes should not be altered, after having once been adjusted under the particular conditions of installation of the meter with respect to vibration of the building, communicated to the meter support, and that due to the alternating current, so that the vibration will not cause the brushes to leave the commutator (which would cause burning and roughening of the latter). Moreover, the commutator should not be cleaned but allowed to tarnish naturally. (Artificial tarnishing of the commutators, with a view to "aging" them quickly, has been tried, but without favorable results as far as the author is aware.) The commutator should not be touched, except in case it is actually burned or roughened; which means that when once the brushes have been adjusted properly for the local conditions of vibration, neither the commutator nor the brushes should be tinkered at any time during the service of the meter or at any testing or recalibration. This point is a most important one in the practical use of commutator meters, and assists greatly in permitting them to be used successfully on alternating-current circuits. Tests show that after the tar-

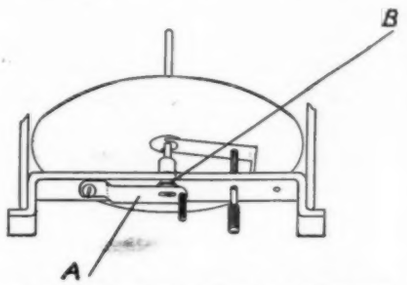


FIG. 14.—JEWEL SUPPORT AND DISK-LIFTING DEVICE.

nishing of the commutator has attained a constant condition the meter will register 98 per cent of the load on light-load tests and 100 per cent on full load, without change, for long periods.

Owing to the natural aging of the commutator by tarnishing, which causes a slightly increased resistance between commutator and brushes, a more powerful shunt-field coil is required for commutator meters employed on alternating-current circuits, in order to start the meter on light load.

The above-described features of operation mean an approach to the possibility of making the commutator meter used on alternating-current circuits a "sealed meter," which need not, and cannot, be tinkered with or "adjusted" by over-zealous meter men making house-to-house inspection trips.

The effect of vibration of the rotating system by the alternating current traversing the meter is regarded as being as detrimental in commutator meters as in induction meters; for, although the "pound" due to the alternating current is of less force in the commutator meter than in the induction meter, the inertia of the rotating system is greater.

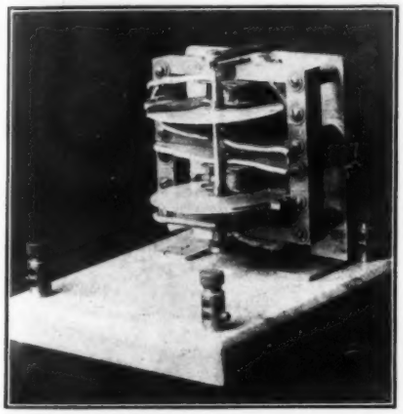


FIG. 15.—MODEL OF DRIVING MECHANISM OF STANLEY DIFFERENTIAL METER.

Lagging of Commutator Meters.—The losses due to the essential inductance of the armature of commercial commutator meters is in fact slight, and these meters would be used on alternating circuits to a greater extent than they are, were it not for their greater first cost, and the greater cost of inspection and maintenance by reason of the commutator and brushes, which are essential parts. At the present time, as far as the writer is aware, only one make of commutator meter—the Duncan—is deliberately put out as an alternating-current meter.

The "lagging" of these meters for use on alternating-current service is necessary when such meters are to be used on loads of low power-factor. This lagging is performed by shunting the series field by a non-inductive resistance, and the method was originated by J. C. Boyd, professor at Ohio State University. It is described briefly on pages 78-80 of the *Proceedings* of the Electrical Society of Cornell University for 1895-96, published by Andrus & Church, Ithaca, N. Y., 1896. It is also mentioned on page 73 of "The Principles of the Transformer," by Frederick Bedell, in the chapter on testing. The method is described in a book entitled "General Data on Thomson Recording Wattmeters," issued by the General Electric Company, August, 1903, as follows: "In using commutator meters on alternating-current circuits having inductive load, lagged meters should be used if the power-factor is liable to be lower than 0.7, but for higher power-factors the lagging is not necessary. These lagged meters are standard in every respect, with the exception of a non-inductive resistance or "lagging strip" connected in multiple with the field coils, thus lagging the field current till it is in phase with the armature current at non-inductive load. This compensation is independent of frequency or "load variations" (that is, presumably, independent of ordinary variations from the normal frequency).

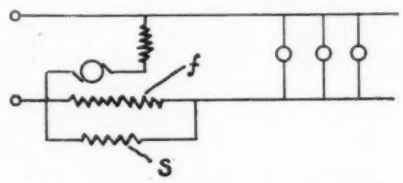


FIG. 16.—CONNECTIONS FOR LAGGING METER.

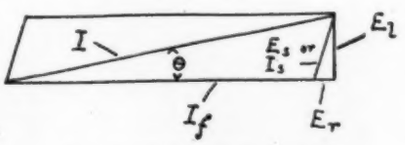


FIG. 17.—VECTOR DIAGRAM.

The necessity of lagging may be explained as follows. In a commutator meter the potential circuit consists of a rotating armature in series with a non-inductive resistance. The former is slightly inductive. Therefore the current in the potential circuit lags slightly behind the impressed electromotive force, and the indications of the meter, calibrated on direct current and used on alternating current, are slightly in error. This error becomes greater when the load circuit has a low power-factor.

The most practical way to counteract this effect is to lag the current in the series field of the meter behind the load current by an amount equal to the lag of the potential circuit, so that the current in the series-field and potential circuits will be in phase when the power-factor of the load circuit is unity. The method is carried out as follows. In the circuit and vector diagrams Figs. 16 and 17 let I_f represent the current in the series field f, and I_s the current which flows through the non-inductive shunt S, connected across the series field; I_s being of course in phase with E_s, the electromotive force at the terminals of the series field. This electromotive force E_s is made up of two components: E_s the electromotive force due to the inductance of the series field, and E_r, the electromotive force due to its resistance. E_s is at right angles to the current in the series field, and E_r is in phase with it. The resultant electromotive force E_s, and therefore the current I_s through the non-inductive lagging strip, is necessarily advanced in phase relatively to the current in the series field, since the two currents I_f and I_s are components of the load current I.

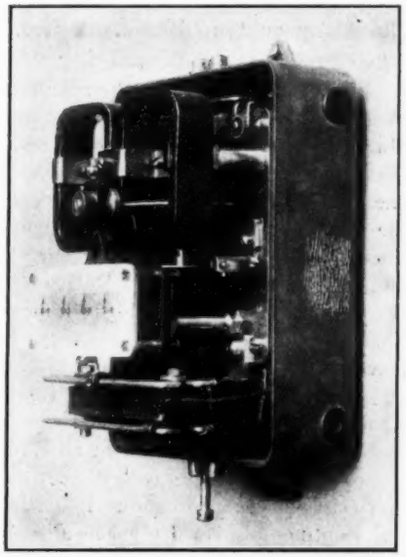


FIG. 18.—INTERIOR OF STANLEY DIFFERENTIAL METER.

Since the current in the series field lags behind the current in the non-inductive strip, it must lag behind the load current, which is made up of the two components, the current in the series field and that in the strip. The amount of phase displacement is de-

termined by the current I_s flowing through the strip and the relation between the resistance and inductance of the series field. The phase of the current in the series field can, therefore, be varied in relation to that in the main circuit within wide limits. When no non-inductive strip is employed, the current in the series field must be in phase with that of the line; and, on the other hand, if it be imagined that a strip is connected which carries so much of the main current that the current through the series field is negligible by comparison, the current flowing through it would then lag by an amount determined simply by its own resistance and reactance.

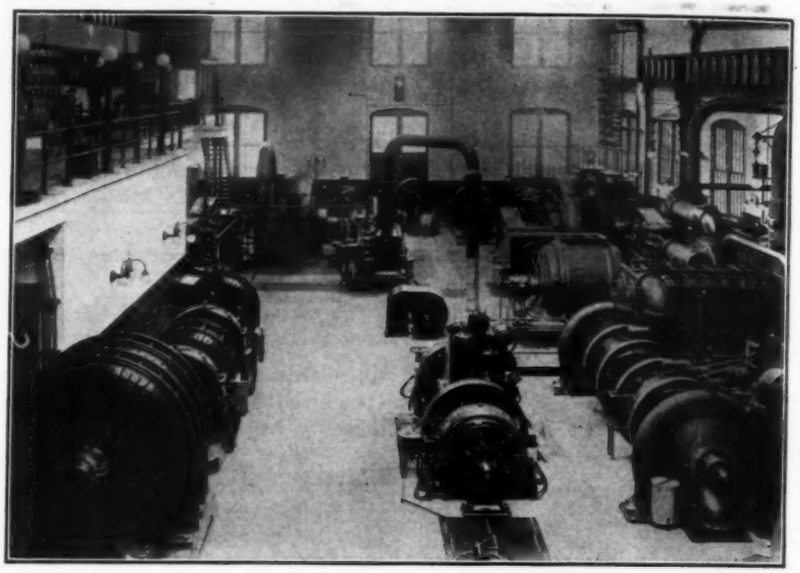
Electricity on the "Sunset Limited."

The electrical equipment of the "Sunset Limited" train, which the Southern Pacific Railway Company is now running semi-weekly between San Francisco, Los Angeles and New Orleans, is one of the most important features of the new train de luxe. Electric lights, fans, telephones, appliances for barbers and hair-dressers, as well as electrically operated block signals contribute greatly to the comfort and safety of travel on this train, which brings New Orleans one day nearer to the Coast. Thousands of dollars have been expended by the railroad company in an effort to make the "Sunset Limited" a peerless conveyance for the discriminating transcontinental traveler. The all-steel Pullman cars which compose the train have been especially constructed for this new service, and all elaborations have been made with the idea of insuring the comfort of the patrons.

Reconstruction of the Rockford Central Station Completed.

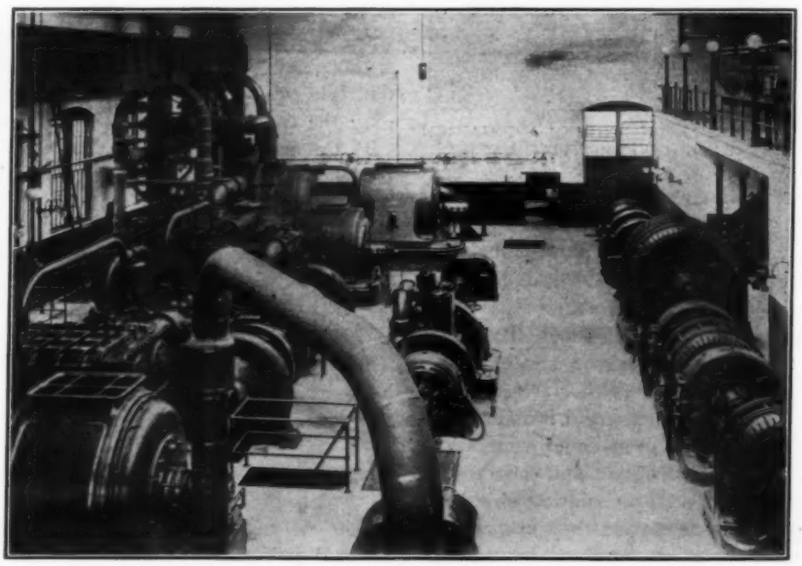
In the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of April 22, of this year, appeared an illustrated article describing the many interesting features connected with the reconstruction of the central station at Rockford, Ill. This work, which has been going on for almost two years without interrupting the service from the plant, is now completed, as is attested by the two accompanying illustrations from photographs recently taken in the main generating room.

Most of the space in the old plant was taken up by sixteen small generators, belt-driven from two long line shafts that were run by seven water wheels and two tandem-compound engines. It was a decided change from this archaic equipment to the strictly modern station shown herewith. The Rockford Electric Company deserves great credit for bringing about so marked a transition in so short a time and so successfully.



NORTH END OF MAIN GENERATING ROOM, ROCKFORD ELECTRIC COMPANY'S STATION.

The general layout of the new station was shown on page 785 of the article referred to. The rated generating capacity of the station is 11,650 kilowatts, which is extraordinary for a city of 46,000 population. There are three main generating units, one of 5,000 kilowatts and two of 2,500 kilowatts capacity. An important feature of the equipment is the provision of eight motor-generator sets for facilitating the interchange of current between the five classes of electric service supplied. These services are sixty-cycle three-phase for general light and power purposes, twenty-five-cycle three-phase for operating interurban-railway substations, 600-volt direct current for local street railway, 230-115-volt direct current for light and power in the center of the city, 6.6-ampere constant direct current for arc street lighting. The station also supplies exhaust-steam heating over a considerable area.



SOUTH END OF MAIN GENERATING ROOM.

Central-Station Practice

Peat as Fuel.

The weaving factory of Hamilton Robb, in Portadown, Ireland, is being driven by gas produced by a working peat plant. It is claimed that the plant, which has a capacity of 400 horsepower, is unique in the extent of its operations.

Simplicity is one of the characteristics of the plant. The peat blocks are placed within a feeding hopper, and from this they pass into a generator, where gasification of the fuel takes place by means of partial combustion. Crude gas is formed and by means of an exhauster fan the gas is drawn off, cooled and purified, all tarry products being removed, and the clean gas passed into a gasholder. From the holder the gas is supplied to the gas engines used for developing the power required to drive the 500 looms in the factory.

The peat is cut from the bog lands on the shores of Lough Foyle, a short distance off, and dried in the open air by the usual methods. In this way the peat, which in its original state contains from 85 to 90 per cent of water, can be dried so as to contain only from 25 to 35 per cent of moisture.

During the past exceptionally warm summer, however, the peat was dried in the open air until it contained as little as 19 per cent of moisture. The makers of the plant state that it can be worked successfully when using peat blocks containing 45 per cent of moisture, although it does not pay so well to use peat in that wet condition.

A series of exhaustive tests of the plant by an engineer has shown that by this system power is obtained at a fuel cost of 0.12 cent per horsepower-hour. The patent tar-extractor fan, which is a feature of the installation, recovers about five per cent in weight of tar as compared with the total weight of peat consumed, and this by-product finds a ready market, especially in connection with the production of vegetable oils. As the respective market values of the peat and the tar are about in the proportion of one to six this means an equivalent return for the by-product of thirty per cent of the fuel cost. The peat plant now in use in the weaving factory replaced an anthracite gas plant.

Winnipeg Lighting Rates Reduced.

The city of Winnipeg, Canada, has definitely fixed the price of light and power in the municipal plant at three cents per kilowatt-hour and the private company has declared it will meet the cut. This is a reduction from the price which prevailed before the civic plant began business of sixty per cent.

OUTDOOR TRANSFORMERS AND SWITCHING STATIONS.—II.

BY STEPHEN Q. HAYES.

OUTDOOR LIGHTNING ARRESTERS.

In addition to the transformers and the circuit-breaking devices just described, lightning protective apparatus has also been developed for such outdoor service. Fig. 9 shows a recent design of electrolytic arrester for use outdoors on a 13,000-volt ungrounded neutral circuit. This 13,000-volt arrester, as well as the 44,000 and 110,000-volt arresters mentioned later, are provided with horn-gap devices usually mounted on pipe framework and arranged so that the length of gap can easily be adjusted while the arrester is in service. As it is necessary to charge this type of arrester periodically, for the purpose of maintaining the film of oxide on the aluminum plate, the horn gaps can readily be placed in such a position that the line current will arc across the gap and charge the cells. In a second position the gaps are so set as to only discharge at a predetermined point slightly above the operating voltage, while in the third position the gap is so large as to prevent the possibility of arcing across and in this manner the gaps act as disconnecting switches when it is neces-

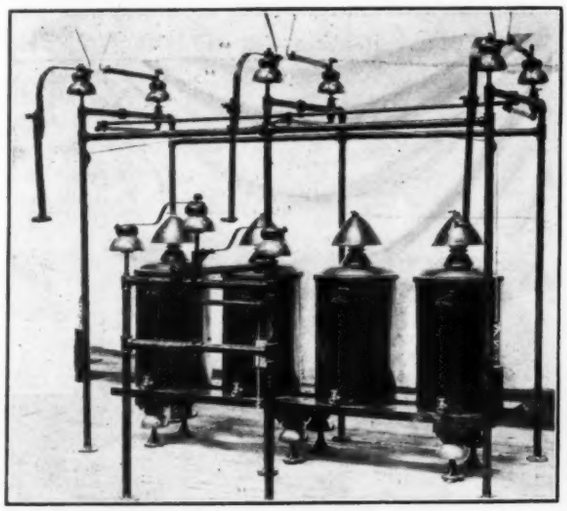


FIG. 9.—13,000-VOLT OUTDOOR ARRESTERS.

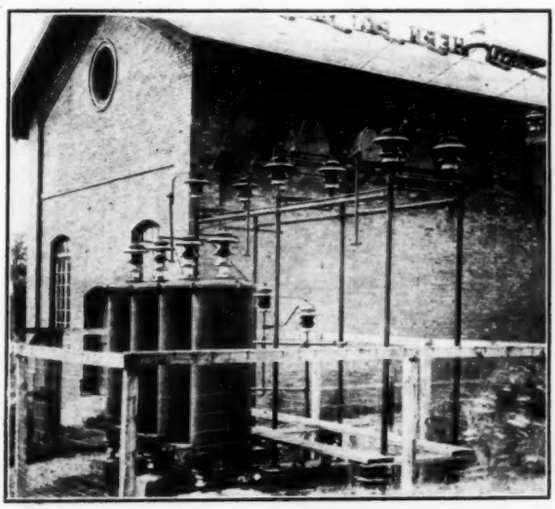


FIG. 10.—44,000-VOLT OUTDOOR ARRESTERS.

sary to inspect the tanks containing the electrolytic cells.

Fig. 10 shows the 44,000-volt, outdoor arrester of this same design, installed outside of one of the substations of the Southern Power Company. The arrester itself, in addition to the horn gaps previously mentioned, consists essentially of a series of nested aluminum cup-shaped trays suitably supported and arranged in steel tanks. These trays contain a liquid electrolyte which forms insulating films on their surfaces; the films prevent passage of current at normal voltages, but break down at abnormal voltages, thus forming a free path for these abnormal voltages or static discharges. On the cessation of the abnormal stress the film regains its original resistance, shutting off the current. The aluminum trays filled with electrolyte are completely immersed in transformer oil contained in steel tanks, which oil provides for insulation and cooling and prevents the evaporation of the electrolyte. The volume of oil, which nearly fills the tanks, is great enough to absorb the heat due to a continuous discharge for long periods.

Fig. 12 shows the electrolytic lightning arrester installed in the 110,000-volt circuits of the Hydro Electric Power Commission of Ontario, near the step-up transformer station at Niagara Falls. In this installation a steel framework was used for supporting the horn gaps, fuses and similar devices. It may be noted that each three-phase arrester previously illustrated comprises four tanks, three of these tanks being connected in star between the outside wires of the three-phase circuits and the remaining tank being connected from the neutral point of this star to ground.

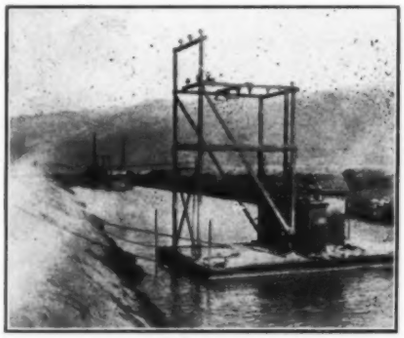


FIG. 11.—33,000-VOLT INSTALLATION OF TRANSFORMERS.

Where a somewhat cheaper form of lightning arrester is required for extremely high voltage and outdoor service, it is possible to adopt the arrangement shown in Fig. 13, which illustrates one type of three-phase lightning arrester used on the 110,000-volt system of the Southern Power Company. With this type of arrester, instead of providing aluminum cells placed in steel tanks in series with the horn gaps, resistances are located in the circuits between the line horn gaps and ground, these resistances being built up in the form of large columns having a large cross section and great heat-absorbing capacities, two columns in series being used between line and ground in each phase. The columns in question are made of a special mixture of concrete and red oxide of iron, and each column is divided up into a number of sections by expanded metal imbedded in the concrete. The edges of this expanded metal are riveted to sheet-metal eaves which prevent water running down the sides of the concrete and thereby obviate the variation in resistance due to the concrete becoming water-soaked. All metal that is liable to rust is galvanized. These sheet-metal eaves have terminals for shunt horn gaps and the operation of these arresters is on the same principle as other shunted-gap arresters. A light discharge passes over the series gap and through the resistances, heavier discharges pass over one or more of the shunt gaps and direct strokes will probably pass over all of the shunted gaps. The arrester, after once having been adjusted, requires no attention or care whatsoever, and is designed to be of such rugged construction as to make it almost impossible for it to be seriously damaged by any discharge which would pass through it. An additional feature of the resistance column is that it has a high resistance for low voltage and low resistance for high voltage, giving in fact a partial safety-valve effect within the resistance itself.

FIG. 12.—110,000-VOLT OUTDOOR ARRESTERS.

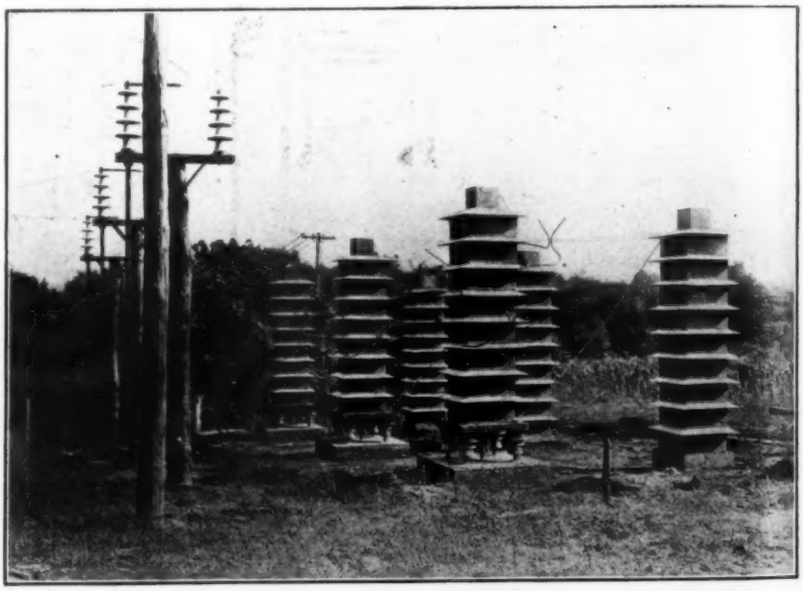


FIG. 13.—CONCRETE-COLUMN ARRESTERS.

ACTUAL OUTDOOR INSTALLATIONS.

As an example of an actual installation of small capacity transformers on a 33,000-volt circuit, Fig. 11 shows an

installation where the transformers, choke coils and similar appliances were mounted on a barge and used for supplying current to motors on dredges.

Fig. 14 shows an installation of 44,000-volt, hand-operated, outdoor-type, oil circuit-breakers for sectionalizing a portion of the transmission lines of the Southern Power Company. As may be noted, the disconnecting switches and wiring are placed on the frame work above the oil circuit-breakers, which are mounted on a brick foundation. A small wooden platform mounted on insulators is provided for the inspection of the breakers.

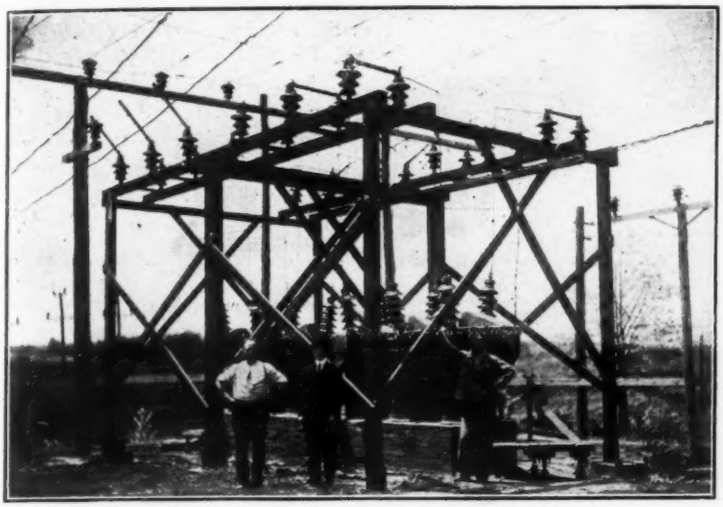


FIG. 14.—44,000-VOLT INSTALLATION OF OIL BREAKERS.

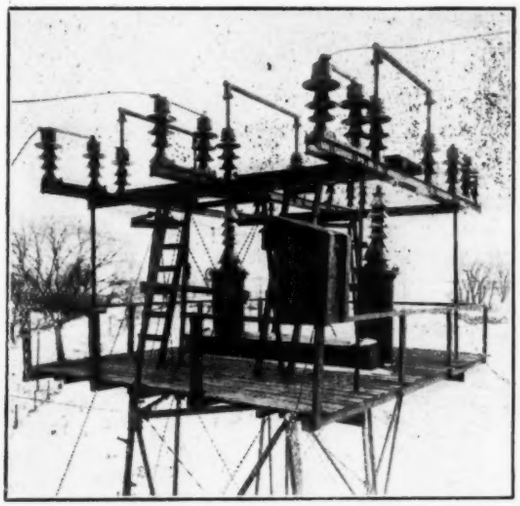


FIG. 15.—66,000-VOLT SERIES TRANSFORMERS INSTALLED.

Fig. 15 shows an installation of 66,000-volt, oil-immersed current transformers, disconnecting switches and similar appliances outside of the stations of the Niagara, Lockport & Ontario Power Company's system.

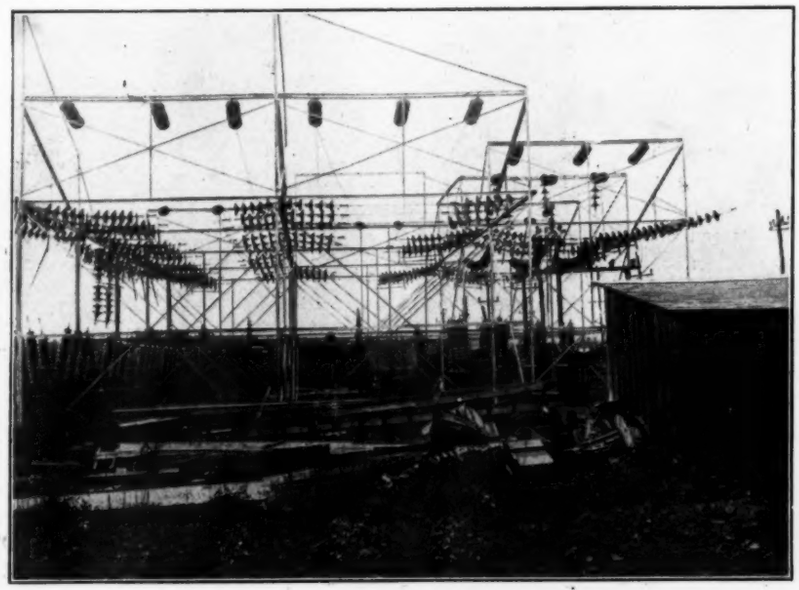


FIG. 16.—100,000-VOLT INSTALLATION OF OIL BREAKERS.

Fig. 16 shows an installation of seven 88,000-volt, outdoor-type, oil circuit-breakers at the Salisbury Switching Station of the Southern Power Company. In this station the oil circuit-breakers are placed on concrete foundations under the steel strain terminal towers to which the lines are brought and which carries the disconnecting switches and the outdoor local busbars. In installing these breakers great care is taken and all joints are painted with a heavy gum to safeguard against the entrance of moisture, and the breakers are painted regularly like any steel work exposed to the weather. Samples of oil are taken from the bottom and the top of the circuit-breaker tanks at regular intervals and any evidence of an excessive amount of carbon in the oil means the immediate change of the oil.

SUMMARY.

The foregoing illustrations and descriptions of outdoor apparatus indicate in a general manner the tendency of design for such installations and in summing up it should be stated that the advantage of outdoor apparatus such as described lies in the cheapening of the installation, due to saving in building, and through the reduction in life and fire hazard, owing to the fact that in an outdoor installation the apparatus can be well scattered without materially increasing the expense of the installation.

The disadvantages are absence of protection from the weather when inspecting, overhauling or making repairs and the danger of trespassers to themselves and to the apparatus. Needless to say, the outdoor apparatus is somewhat more expensive than the corresponding indoor apparatus, but the difference in cost will be usually far more than offset by the saving in building.

In considering whether an outdoor installation is justified or not, all these points have to be given due consideration.

An electromagnet described in a recent number of the *Scientific American* is designed for extracting particles of iron from the eye and is also turned to use in taking out iron and steel splinters from wounds.

New Plant for Battle Creek.

A new electric power plant costing $250,000 is to be constructed in Battle Creek, Mich., by the Commonwealth Power Company and work will begin at once. The plant will be a terminal of a long high-tension line, running from the Au Sable river to this city, a distance of 250 miles.

The construction of the plant is to be of pressed brick and cement, much like the plants recently erected about the state by the Commonwealth Company. The Battle Creek plant will supply feed wires to Kalamazoo, Jackson, Lansing, Sturgis and Ceresco. As is generally known in Michigan, the Au Sable supplies feed wires for many cities, but a portion of the time, when the dam is frozen, the Au Sable plant is sorely handicapped. The new Battle Creek plant will act as a standby plant. A right of way has already been surveyed to the new power plant, following the stream of the Battle Creek and cutting across the city's property at Verona, while franchises for the entire route from Au Sable have been obtained.

Another Municipal Lighting-Plant Failure.

After making an inventory of the municipal electric lighting plant at Romeo, Mich., the Eastern Michigan Edison Company has submitted a proposition to purchase the same. The plant has never paid operating expenses since being installed, twelve years ago, and there is a bonded debt against the plant of $15,000. In view of the fact that another engine will soon have to be purchased, which means another bond issue, the people generally seem to favor the sale of the plant, for which the Edison company will pay $18,000. The company asks for a thirty-year franchise to light the streets and quote a price of $18 per year for each 60-candlepower tungsten lamp, and $24 for each 100-candlepower lamp. All-night service would be given and day service as well, while now the arc lights are discontinued at midnight and there is no electricity generated during the day.

Exports of Copper.

Exports of copper for the week ended December 14 were 6,603 tons. The amount since December 1, 15,244 tons, as compared with 14,139 tons for the same period last year.

Installing a High-Power Switchboard in a Limited Space.

The accompanying photograph illustrates a switchboard installation controlling about 2,000 horsepower in induction motors driving the machinery in a large grain elevator at Boston, Mass., the equipment being located in a highly restricted area between the outer wall of the elevator building and working section of the first floor, with a stairway and elevator well adjoining one corner. The possibilities in this case were limited by the necessity of keeping the elevator building free for the handling of grain between cars, bucket elevators, platforms, bins and other divisions of the structure, and the presence of a public street on the outside wall made the establishment of the controlling switchboard unusually difficult. The problem was solved by arranging the board in a double row of panels facing a common central aisle, the whole being contained in a concrete and steel chamber about 34 feet long by 14 feet in width. About 50 motors are controlled from this point, including a number driving elevated wharf conveyors many hundred feet distant from the switchboard. The compactness of the installation is all the more apparent from the fact that every motor in the entire plant is started from the panels shown in the illustration, special busbars being provided to enable the operator to throw reduced voltages upon the motors when bringing them up to speed. At the motors themselves the only equipment installed is a system of push-button signalling and emergency stopping switches, the annunciators of which are located in the fireproof switchboard room together with various telephone, signaling and lighting apparatus.

A COMPACT SWITCHBOARD ARRANGEMENT.

Lectures on Illumination and Photometry.

At University College, London, Eng., a course of eight lectures on illumination and photometry will be begun on January 10, 1912. Prof. W. C. Clinton will give the lectures.

New York Edison Educational Display in Christmas Decoration.

In response to public feeling, dealers in electric light fixtures have arranged the now well known "Christmas sets," consisting of small fancy colored bulbs designed especially for this holiday usage. Since these came upon the market, the New York Edison Company, in the interests of a "safe and sane" Christmas has tried many ways of introducing these outfits to the public.

Since practice is always better than preaching, the company has hit upon the scheme of placing large Christmas trees, beautifully decorated, in the windows of all of the five branch offices where show-rooms are maintained. The object of this is to show that the same lovely effects can now be reached without that element of danger which rendered the old-fashioned tree a thing of menace, if a delight to the eye. These Christmas windows of the New York Edison Company have proved very popular with the New York public, and the decorations have attracted the attention of people from every section of the city and country. The illustrations reproduced herewith give some idea of the alluring display made for this holiday season by the New York Edison Company.

SEVERAL VIEWS OF THE SPECIAL CHRISTMAS DISPLAY BY THE NEW YORK EDISON COMPANY.

Telephony · Telegraphy and Wireless

SOME OBSERVATIONS ON TELEPHONE AND TELEGRAPH PRACTICE IN ENGLAND, MAY AND JUNE, 1911.

BY ANGUS S. HIBBARD.

The short time usually allotted to the American tourist for visiting London and its vicinity is generally so fully occupied in seeing the many historical and interesting sights which must not be missed that the time remaining for business consideration is much restricted. This, at least, has been my experience on two previous trips, and I am now realizing how much more valuable to me has been my recent visit, which gave opportunity, in a stay of about six weeks in London, to look more carefully into telephone and telegraph matters which have interested me so much. As regards the telephone, I am impressed with the change in the attitude of the public which has taken place during recent years, and which is still going on. About ten years ago it seemed to me to be a frequent practice for one telephone user to call another, with more or less difficulty, and ask, "Are you there?" Being assured by the other that he was "there," the caller would say, "I'll be right over, I want to speak to you." Four years ago I noted, in connection with a marked growth and improvement in the service, a growing disposition to go ahead and do the talking by telephone after the caller had found that the person desired was finally "there." This year I find conditions still further changed, the service being much extended and improved. The "Are you there?" expression, in its old sense, has largely disappeared, and, fortunately, has not been replaced by the useless "Hello!"

Modern relay switchboards, now generally used in the large exchanges, give a more rapid and dependable service, which suffers principally because it is furnished by two separate authorities, the Postoffice and the National Telephone Company, a divided responsibility which, even with the best intentions, cannot give the best results.

This division of interest, one branch of which is so soon expiring, has evidently retarded the growth of the business, and to a considerable extent has kept back the necessary provision of facilities required to handle it to the best advantage. There are many evidences that the public, meanwhile, is acquiring the telephone habit, and following the consolidation of the service into one organization under the postoffice, an unprecedented growth will, I believe, take place. The policy announced by Mr. Samuel, Postmaster General, that the department proposes to proceed with the telephone as a great commercial enterprise on broad and comprehensive lines, gives assurance that under his direction this development will be speedily taken in hand. London, therefore, presents today probably the largest and most interesting problem in telephone engineering. It will be a great work to prepare the plans and specifications for a twenty-year growth, to fix exchange boundaries, plan for main subway and distribution work, and prepare exchange equipment and cable and wire facility plans adequate for each situation. Other cities in Great Britain present the same problems, now made the more interesting from the fact that all the wire facilities for the postoffice, both telephone and telegraph, may be planned for and co-ordinated into one comprehensive system with marked advantages to both branches of the service. Members of the staff may be congratulated upon their opportunity to participate in this interesting work.

While in some minor points the central-exchange equipments are not exactly of the kind now used in America in like situations, the installations are very similar, and from cable heads through distributing boards and relay racks to final A and B boards, the large offices are practically similar to those in the States. The good discipline and attention of telephonists while on duty was apparent in every office I visited, and my observations indicated that their courtesy was unfailing.

My special task was to look into the workings of the telephone and the telegraph where the two systems were used together to transmit or receive telegrams, and I found in the routine and manner of working much that was interesting and instructive.

One feature which has so worked itself into every-day practice as to become involuntary, is the use of analogy in making certain the spelling of words where spelling is necessary. In upwards of fifty offices visited I found telegrams being transmitted and different words or phrases treated in this manner so easily and so surely that there seemed to be no possible doubt at either end of the line as to the correctness of the message, and in the many tests and observations made I did not note a single error in address, message or signature. The method of analogy is not new, but in America it seems to be resorted to as the last way of making sure of some one letter when other means have failed, whereas English practice trips it off at once for all the letters of any difficult word, and does it quickly and accurately. When I first heard my test message being sent by a clerk in a London branch postoffice located in a greengrocer's shop, I did not know whether I was listening to a compendium of proper names or an order for red herring, but in a moment, realizing what was going on, the letters were made absolutely certain, and very soon "A for Alfred," "C for Charley," "E for Edward," etc., appeared as instant and involuntary pictures of the letters designated. I had many evidences that the telephone users were also employing the same means of making sure in telephone conversations of all kinds. Indeed, on one occasion a clerk in a district messenger office selling me some theater tickets, across the counter said, "There you are, sir, row G., G. for George, 8 and 9, thank you, sir," and I was perfectly sure of row G. because he said "G. for George." This extended reference to analogy may seem a bit trivial at first, but observations of its practice convinced me that in England it has grown into a quick and accurate means of

making sure of just what is being said or heard over the telephone, and has so grown into the service that its use is understood and expected by all.

The postoffice practice, extending over a period of several years, has shown that telephones are successfully used instead of telegraph instruments in handling telegrams at branch offices. The telephone was very generally preferred by the staff employed at nearly every office I inspected. At one office where I was told the sounder was preferred, the preference disappeared when the postmaster was informed that the salary was the same, when he said, "Oh! of course, in that case I prefer the telephone." A number of tests showed the telephone to be quicker than sounder work, while it did not require the special skill of a Morse operator, and the assurance of correctness by repeating back the message was much appreciated and commented upon. Its greater use for short-distance telegrams seemed to be desired in all the districts I visited. The telegraph workings in the large offices interested me very much, especially results from the Wheatstone, Creed, and Baudot systems.

The telegram concentrators were most interesting, and their application, as I saw them, excellently worked out. The greatest delay in handling telegrams is no doubt caused by the prevailing use of code addresses, making reference to books of code words necessary before telegrams can be delivered. This delay under the present system seems unavoidable, but it must cost fully as much as the sum received annually for the registration, and involves the greatest delay experienced in any part of the telegraph system. I am sure I should prefer the American plan of free addresses, especially when telephone addresses are used, making immediate delivery by telephone possible. The number of telegrams between two points in London, while decreasing on account of the more frequent use of the telephone, still seems very great. Telegrams costing a shilling or more, which could be telephoned direct for twopence, are still in evidence. The adoption of a telephone address, recommended by the committee investigating telephone deliveries, will do much to speed up a considerable proportion of the London service.

Each day of my visit presented opportunity to investigate matters which were interesting and instructive, and I shall watch with renewed interest the important developments of the service which are anticipated in the near future.

I wish to express to Mr. Samuel, Postmaster General, and to his staff and the officers of the National Company, my sincere thanks for their cordial reception and the facilities afforded for the inspection and study of the problems in hand. For myself and associates I may say that we appreciate the opportunities we have had in the past of meeting in America representatives of our craft from England, and hope there may continue to be frequent visits and renewals of the acquaintances and friendships so pleasantly made.

Professor Bell's Telephone Prophecies of Thirty-Three Years Ago.

In March, 1878, while endeavoring to secure capital for developing the telephone in England, Alexander Graham Bell, the inventor of the telephone, delivered the address published below on the future of the telephone. At that time there were no telephone exchanges, and this prospectus was probably the first suggestion of such development and of the various uses of the invention that was soon to become the great necessity of the social and commercial life of the civilized world.

At Kensington, England, on March 25, 1878, Professor Bell presented the following description of the telephone and its probable uses:

To the Capitalists of the Electric Telephone Company:

It has been suggested that at this, our first meeting, I should lay before you a few ideas concerning the future of the electric telephone, together with any suggestions that occur to me in regard to the best mode of introducing the instrument to the public.

The telephone may be briefly described as an electrical contrivance for reproducing in distant places the tones and articulations of a speaker's voice, so that conversation can be carried on by word of mouth, between persons in different rooms, in different streets, or in different towns.

The great advantage it possesses over every other form of electrical apparatus consists in the fact that it requires no skill to operate the instrument. All other telegraphic machines produce signals which require to be translated by experts, and such instruments are therefore extremely limited in their application, but the telephone actually *speaks*, and for this reason it can be utilized for nearly every purpose for which speech is employed.

The chief obstacle to the universal use of electricity as a means of communication between distant points has been the skill required to operate telegraphic instruments. The invention of automatic printing, telegraphic dial instruments, etc., has materially reduced the amount of skill required, but has introduced a new element of difficulty in the shape of increased expense. Simplicity of operation has been obtained by complication of the parts of the machine—so that such instruments are much more expensive than those usually employed by skilled electricians. The simple and inexpensive nature of the telephone, on the other hand, renders it possible to connect every man's house, office, or manufactory with a central station, so as to give him the benefit of direct telephonic communication with his neighbors, at a cost not greater than that incurred by gas or water.

At the present time we have a perfect network of gas pipes and water pipes throughout our large cities. We have main pipes laid under the streets communicating by side pipes, with the various dwellings, enabling the members to draw their supplies of gas and water from a common source.

In a similar manner it is conceivable that cables of telephone wires could be laid underground, or suspended overhead, communicating by branch wires with private dwellings, country houses, shops, manufactories, etc., etc.—uniting them through the main cable with a central office where the wire could be connected as desired, establishing direct communication between any two places in the city. Such a plan as this though impracticable at the present moment, will, I firmly believe, be the outcome of the introduction of the telephone to the public. Not only so but I believe in the future wires will unite the head offices of telephone companies in different cities and a man in one part of the country may communicate by word of mouth, with another in a distant place.

I am aware that such ideas may appear to you Utopian and out of place, for we are met together for the purpose of discussing, not the future of the telephone, but its present.

Believing, however, as I do that such a scheme will be the ultimate result of the telephone to the public I will impress upon you all the advisability of keeping this end in view, that all present arrangements of the telephone may be eventually realized in this grand system.

The plan usually presented in regard to private telegraphs is to lease such lines to private individuals, or to companies at a fixed annual rental. This plan should be adopted by you, but instead of erecting a line directly from the one to another I would advise you to bring the wires from the two points to the office of the company and there connect them together; if this plan be followed a large number of wires would soon be centered in the telephone office where they would be easily accessible for testing purposes. In places remote from the office of the company, simple testing boxes could be erected for the telephone wires of that neighborhood, and these testing places could at any time be converted into central offices when the lessees of the telephone wires desire intercommunication.

In regard to other present uses for the telephone, the instrument can be supplied so cheaply as to compete on favorable terms with speaking tubes, bells and annunciators, as a means of communication between different parts of the house. This seems to be a very favorable application of the telephone, not only on account of the large number of telephones that would be wanted, but because it would lead eventually to the plan of intercommunication referred to above; I would therefore recommend that special arrangements should be made for the introduction of the telephone into hotels and private buildings in place of the speaking tubes and annunciators, at present employed. Telephones sold for this purpose could be stamped or numbered in such a way as to distinguish them from those employed for business purposes, and an agreement could be signed by the purchaser that the tele-

phones should become forfeited to the company if used for other purposes than those specified in the agreement.

It is probable that such a use of the telephone would speedily become popular, and that as the public became accustomed to the telephone in their house, they would recognize the advantages of a system of intercommunication. When this time arrives, I would advise the company to place telephones free of charge for a specified period in a few of the principal shops so as to offer to those householders who work with the central office, the additional advantages of oral communication with their tradespeople. The central office system once inaugurated in this manner would inevitably grow to enormous proportions for these shop-keepers would thus be induced to employ the telephone and as such connections with the central office increased in number, so would the advantages to householders become more apparent, and the number of subscribers increased.

Should this plan ever be adopted, the company should employ a man in each central office for the purpose of connecting the wires as directed. A fixed annual rental could be charged for the use of the wires, or a toll could be levied. As all connections would necessarily be made at the central office, it would be easy to note the time during which any wires were connected and to make a charge accordingly. Bills could be sent in periodically. However small the rate of charge might be, the revenue would probably be something enormous.

In conclusion I would say that it seems to me that the telephone should immediately be brought prominently before the public as a means of communication between bankers, merchants, manufacturers, wholesale and retail dealers, dock companies, water companies, police offices, fire stations, newspaper offices, hospitals and public buildings, and for use in railway offices and in mines.

Arrangements should also be speedily concluded for the use of the telephone in the Army and Navy and by the Postal Telegraph Department.

Although there is a great field for the telephone in the immediate present, I believe there is still greater in the future.

By bearing in mind the great object to be ultimately achieved, I believe that the Telephone Company can not only secure for itself a business of the most remunerative kind, but also benefit the public in a way that has never previously been attempted.

TELEPHONE TRANSMISSION ENGINEERING.[1]

BY FRANK B. JEWETT.[2]

Using the terms in their accepted sense, I think that nearly all of us who are connected with the operating side of the telephone industry are of necessity transmission engineers. To illustrate this point we have only to remember that in the last analysis, the one thing that the telephone company sells and the sole license it has for existence is the electrical transmission of speech over wires. We don't sell a fine grade of signaling, although I will admit there was a time when it really looked as though that was our principal production, nor do we sell quick and ingenious operating methods, nor well thought out commercial plans of elaborate systems of accounting. I merely wish to impress upon you that it is for ability to talk and talk intelligibly and without undue effort that the telephone subscriber is willing to pay out his more or less hard-earned shekels. Unless we can afford him this facility with a reasonable degree of regularity we are doomed to lose not only our reputation but our license to do business. Under such circumstances our retrospective satisfaction in, say, a wonderful signaling circuit or an improved operating method, would be very much the same as the satisfaction of the surgeon who is forced to report "Operation successful, but patient died."

Telephone transmission is, like almost everything else with which we have to deal in this world, i. e., the better the quality of the thing sought the more it will cost us; thus the higher the standard, that is the louder the volume supplied to each individual subscriber, the more in general will we have to charge in order to secure a reasonable interest return on the money invested. Consequently, the general manager is between the Scylla of a transmission standard with fixed charges so high that they will act as a deterrent on the use of the telephone and the Charybdis of transmission so poor that nobody will wish to employ the service.

There is no hard and fast rule of what constitutes a commercial grade of transmission. In fact, what constitutes a proper standard in one locality under the conditions existing there may be absolutely uncommercial in another locality under different conditions.

It can be set down as an almost universal and certainly a good working rule, that the best transmission between two subscribers will be obtained when the circuit connecting them most nearly approaches the condition of two wires without intermediate bridged or series apparatus, that it is best when the line is shortest and wholly in open wire and that where cable is used it should be in minimum amount and of as large gauge as possible. Also that in common-battery installations, increasing distance of the subscriber's instrument from the central office brings in a rapid deterioration in the transmission.

Bearing these facts in mind, let us consider an example in which the commercial department is involved. One of the commonest cases which arise is that concerning long loops or extensions from private-branch exchanges. The very fact that there is a private-branch exchange takes the case some distance from the ideal condition that there should be no intermediate apparatus while the long loop takes it further.

Take the case of a traffic man assigning circuits for any given class of service. He is in a position to make or mar the success of the service as a whole by an improper use of the facilities at his disposal. In every case he should bear continually in mind the absolute necessity of assigning his very best circuits to the service having the most severe transmission requirements, and by very best circuits I mean very best from one end to the other. A common error which has come under my observation is the assumption on the part of those responsible for circuit assignment that the grade of the circuit is determined by the grade, say, of the open-wire portion of the circuit. While this may be true in general, it is not universally true, and we have found in many instances cases of long-haul circuits assigned in large-gauge open wires but terminating in considerable lengths of small-gauge cable conductors, with a net result that the transmission is poorer than it would have been if the circuit had been routed over smaller gauge open wires containing less lengths of cable or cable of larger gauge.

Transmission itself is such an intangible thing to most of us, while the saving of a dollar or two dollars on a cord circuit or a few cents on an insulator is so real that there is a very great temptation to practice that sort of economy, which in the long run is the wildest kind of extravagance.

In the outside plant department numerous instances might be cited where apparent savings are really a flagrant waste of money in the long run. One of the commonest and most plausible of these mistakes is the line of reasoning we employ when it becomes necessary or apparently necessary to replace open-wire circuits with cable. Under these conditions it is common practice

1 Extracts from a paper read before the Philadelphia Telephone Society, November 14.

2 Transmission and protection engineer, American Telephone & Telegraph Company.

to make certain assumptions and determine that such and such a grade of cable conductor is in cost equilibrium with the particular gauge or gauges of open wires involved. This having been done, we are content to take down the open wires, put in the cable and think we have done a first-rate job, forgetting that the actual transmission has been impaired by the substitution and the potential earning capacity of the line reduced.

As I view it, the three important functions of the transmission engineer in an operating company are:

1. The determination of what can be done with different types of existing construction and equipment and the furnishing of suitable engineering advice regarding standards of transmission.

2. The giving of specific advice as to what is needed in any given installation to insure the desired grade of transmission at a minimum cost, due consideration being given to the future needs of the system as a whole.

3. The furnishing to each and every one of the operating department such rules and statements as will enable them to know how to perform their respective duties, so far as concerns transmission and in a general way what results are likely to follow certain classes of deviation from best methods.

A fourth duty which devolves upon the transmission engineer, although particularly upon the central transmission department, is the work needed to improve the transmission efficiency of various parts of the plant.

From time to time particularly aggravated cases of poor transmission come up and are given a most thorough consideration. While this consideration frequently discloses the presence of theoretically improper plant, I feel perfectly safe in saying that the great bulk of the trouble disclosed is traceable to errors in installation, assignment and maintenance, for which there is little or no excuse. A plant which theoretically should give, even with the most liberal allowances, not to exceed 30-mile transmission from subscriber's instrument to subscriber's instrument, is frequently found to give 40 or 45-mile transmission, and what does a careful investigation disclose?—frequently the presence of a receiver wired in the line, defective cords, improperly maintained batteries, the unrecorded presence of inefficient circuits for a considerable part of the distance, receivers with rusty pole pieces and bent diaphragms, open-wire lines in poor maintenance condition and sometimes, in the case of private-branch exchanges, operators' cord circuits, which have a habit of taking the transmitter current supply from the talking pair.

BATTERY ECONOMY.

BY E. E. GEORGE.

To those who prefer dry batteries for all electrical work, the following method of using them on closed circuits will prove valuable. This method permits the use of dry or other open-circuit batteries on telegraph or telephone lines where the circuit must be left closed.

The ordinary methods of doing this require sufficient battery power at each end of the line to operate the system. This doubles the necessary cost of batteries.

The better method is to get just enough batteries to operate the system, place half of them at one end of the line and half of them at the other, and connect the zincs at both ends of the line to one wire, and the carbons to the other, or to the ground. The voltages of each set are equal and opposite, and no current flows on the line.

When either party wishes to call the other, he simply reverses the connections of his set of batteries and uses the instruments. This reversal causes both batteries to add their voltages and send their full current through the line. When through talking, he reverses the connections to their original condition. The direction of the current through the line depends upon which party has called the other.

The apparatus may be grouped in any way and distributed anywhere on the line. The only condition to be observed is that the open-circuit voltages of the two sets of batteries be equal, so that no current will flow till one set is reversed. Any kinds of batteries may be used together. A telegraph line operated on this principle was in successful operation for some time. Three or four makes of dry batteries, National, Grenet and Le Clanche cells were used on the same line together.

This principle can be used for other circuits than those mentioned.

Water Does Not Always Give Good Telephone Grounds.

I have had difficulty, says S. Price, plant chief of the Canadian Bell Telephone Company, in a letter to the *Telephone Gazette*, in convincing men that water in itself is not a good ground, and have often told the following stories in confirmation:

Trouble was reported on a certain single line and upon test it was found that at times it would work fairly well, and at other times it appeared to be heavily grounded. We found the line untied from a side block and lying in a stream, but not touching the bottom. There was a stone quarry further up the stream, and when the wheels were running the water in the brook became dirty, and the line would not work, but when the wheels stopped the water became clear, and it was possible to ring and talk through the water.

On another occasion a lady reported that in the afternoon about five o'clock she could not get central, but about six she could; and that at some other times she could, but at other times she could not. It took me quite a while to find that trouble, because sometimes at five p. m. she could get central.

The instrument was grounded on an iron pump pipe. The pipe did not touch bottom. The lady would go out in the afternoon visiting, and when she got home would go straight to the telephone to call up, but as the well had had all the afternoon to settle, and the water was clear, she could not get central. After pumping water and getting supper ready the water was stirred up a little, and she could get central.

Competing Telephone Companies at San Francisco Ask Permission to Merge.

A petition has been filed by officials of the Bay Cities Home Telephone Company of San Francisco, Cal., and the Pacific Telephone & Telegraph Company, with the supervisors of San Francisco, asking that the former be permitted to dispose of its holdings to the latter (Bell) company. It is stated that the details of the transfer have been agreed to by the parties in interest, and afford advantages to the public as a whole.

Over 8,500,000 acres of land are leased for oil and 700,000 acres are owned in fee by oil operators in the United States.

BOOK REVIEWS.

"Medical Electricity and Roentgen Rays." By Sinclair Tousey. Philadelphia and London: W. B. Saunders. Cloth, 1,116 pages (6x9¼ inches), illustrated, partly in colors. Supplied by the Electrical Review Publishing Company for $7.00.

The author of this volume is consulting surgeon to St. Bartholomew's Clinic in New York City and has brought his rich experience to the preparation of this volume. The treatise is very comprehensive, since it covers not only physiologic and therapeutic effects of electricity, but devotes considerable space to the apparatus and appliances used by the medical practitioner and by the electrical scientist, and gives explanation of the electrical properties and principles in the way of giving working knowledge of these to the reader who has had no scientific or technical training. The general principles of electrical apparatus are stated in a manner which is highly admirable when the class of readers of such a volume is considered. Many of the statements would seem perhaps amateurish or insufficient to the engineer, and a number of errors in the scientific and technical statements may easily be discovered. Some of these are probably merely oversight, as for instance, on page 43, where microcoulombs per second are stated to equal milliamperes, and as on page 47 where a given capacity for a condenser is said to be given by 1,200 square inches of tin foil, without any mention being made of the necessary thickness of the dielectric. The absolute unit weber is given in place of the maxwell as the practical unit of magnetic flux. On page 129, self-induction is stated to be a function of the voltage, where the meaning probably is that impedance depends upon frequency. The definition of the henry (the unit of inductance) is incorrect.

The use of a resistance in series or in parallel for control of a voltage is very badly stated on page 197, and the description of the diagrams rather misleading. On page 229 the statement is made that the charge of the condenser varies as the square of the potential, this misconception probably arising because the energy of a charge varies with the potential in this way. On page 593 the values given for the temperature of the carbon arc are not at all in accord with recent determinations.

In spite of the many cases noted of technical inaccuracies in this volume, most of which are of little importance to the medical practitioner, the volume forms a most valuable reference work in its subject and will be a valuable accession to any library. The classification of electricity as static, voltaic, faradic and galvanic seems curious to the engineer, although probably valuable for the purposes used, since it represents different methods of generating the necessary current or potential. The physiologic and pathologic effects of electricity are very thoroughly treated and chapters are devoted to electro-diagnosis and ionic medication by electrolysis. High-frequency current, the effects of which are of more modern discovery, also comes in for a comprehensive treatment. Phototherapy is rather briefly treated.

Nearly one-half of the treatise is devoted to the X-ray, and the technique of this subject is probably nowhere more fully discussed. Full directions for the handing of X-ray apparatus and for securing good radiographs are given and many excellent examples are illustrated. The use of the X-ray in the treatment of disease is gone into very thoroughly and the injurious physiological effects are fully stated. A chapter is devoted to radium and its physiologic and therapeutic effects.

"The Propagation of Electric Currents in Telephone and Telegraph Conductors." By J. A. Fleming. New York: D. Van Nostrand Company. Cloth, 316 pages (5½x8½ inches), illustrated. Supplied by the Electrical Review Publishing Company for $3.00.

This volume is a reproduction, with some additions, of a lecture course given by the author at the University of London, which was intended principally for practical telegraph and telephone engineers and experts. Much of the matter utilized in its present form is new and should prove very valuable to the class of readers for whom it is intended. The mathematical introduction, which takes up the vector representation of electrical quantities, hyperbolic trigonometry, etc., is very well written and presupposes no knowledge of these matters on the part of the student. Familiarity with the calculus is very necessary to a perusal of the work. While the fundamental equations bearing upon the phenomena considered have been well known for a long time, the solution of these and their application to special cases has never before been put in such an available form for use in practical problems. Professor Fleming has done a distinct service consequently in making the solution of the fundamental equations easily available for students of this subject, and for showing them how to apply the solution to curves of arrival and similar practical phenomena. Fortunately his system of vector rotation agrees with that adopted at Turin. The propagation of currents in submarine cables is very thoroughly considered. The discussion of telephone cables occupies a large portion of the volume and the theory of loading is thoroughly discussed. The last chapter gives the practical results which have been obtained with Pupin coils and is the most complete compilation of these results which the reviewer has so far seen.

As is quite natural in a work of this kind a number of typographical errors have been introduced. Thus, for instance, in the formula at the bottom of page 27 the hyperbolic tangent of b is given in place of the natural tangent. On page 42 the formula for the inverse hyperbolic sine of a complex quantity is incorrect.

"Smithsonian Physical Tables." By F. E. Fowle. Fifth revised edition; Washington: Smithsonian Institution. Cloth. 318 xxxiv pages (6x9 inches). Supplied by the Electrical Review Publishing Company for $2.00.

The new edition of Smithsonian Physical Tables represents a complete revision such as has not been undertaken since the tables were first published in 1896 as compiled by Thomas Gray. The help of the various government bureaus in Washington has been enlisted in the present revision and the tables represent a great improvement over previous editions both as regards the reliability of the data and the completeness of ground covered. The volume will prove invaluable to those who find it necessary to frequently refer to authorities for the value of physical constants and similar data. Several mathematical tables have also been included.

"Testing of Electrical Machinery." By J. H. Morecroft and F. W. Hehre. New York: D. Van Nostrand Company. Cloth, 154 pages (5½x9 inches). illustrated. Supplied by the Electrical Review Publishing Company for $1.50.

This book is intended for non-electrical students who have to deal with testing of electrical machinery as part of their schooling, but who do not study the theory of electrical ma-

chinery. Before giving specific directions regarding the test to be performed, a brief analysis of the characteristics of the machine is given, and in so far as is possible in the limited space the reasons for the behavior of the machine are given. The book is divided into two sections, the first dealing with eleven direct-current tests and the second with nine alternating-current tests.

California Passes Utility Law.

The Burnett-Sutherland-Ehleman bill, known as the Railroad Commission Act, or Public Utility Law, has been passed by the California State Legislature at a special session called by the Governor. The law is drafted in accordance with the recent amendment to the state constitution, ratified at a special election in October[1], and repeals the State Railroad Commission Act of the last regular session of the Legislature. It was prepared by an appointed legislative committee composed of Senator Lester G. Burnett, Assemblyman W. A. Sutherland and J. M. Eshleman, president of the State Railroad Commission, and others, with the approval of the Governor. The bill extends the powers of the Commission over all public utilities in the state, and becomes effective within ninety days after the close of the special session.

By the provisions of the law the State Railroad Commission is increased from three to five members, appointive by the Governor (instead of elective as heretofore) at an annual salary of $6,000 each. The three commissioners now in office will serve out their terms, and two additional commissioners will be immediately nominated. The bill defines public utilities, as relating to individuals or corporations and declares full jurisdiction over all such. The Commission is empowered to pass upon the stocks and bonds offered for sale; to provide that all funds from such securities are invested as stipulated, both items being subject to full review; to investigate properties for physical valuation; to establish and fix rates for respective service to be rendered; and to order such extensions and improvements in properties and service as it may deem necessary. Extensions or construction of street railways must be applied for, and such application to be accompanied by a "certificate of public necessity." In the case of steam lines this is not required.

The bill provides that an incorporated city may vote to retain control of public utilities within its jurisdiction. A corollary bill, passed in company with the Public Utilities Law, allows for an appropriation of $210,000 for the use of the Commission in carrying out the provisions of the act.

Lower-court procedure is denied corporations in appeals from the Commission's decisions on writs of certiorari, and supreme-court action may only be had with relation to questions of law, and not of facts. All questions of fact are to be determined solely by the Commission, which is not guided by any established procedure in rules of evidence or the taking of testimony. The common law recourse of appeal to the superior court is taken from the corporation by the provision that the petition for the writ lies only with the higher tribunal. A.

Public Service Discussed at Los Angeles.

The regular monthly meeting of the the Los Angeles Section of the American Institute of Electrical Engineers was held in company with the members of the Engineers and Architects' Association of Southern California at an informal dinner at Hamburger's Cafe, December 19, with an attendance of close to one hundred and fifty.

The subject for discussion, "Public Service," was preceded by a short address by Frank A. Wolff, of the Bureau of Standards, Washington, D. C. Mr. Wolff's visit to the city, brought about through representing the Bureau at the Los Angeles electrical show, has so impressed him, he stated, that he considers favorably the establishment of a branch of the department on the Coast.

Theodore B. Comstock, engineer for the Los Angeles Board of Public Utilities, offered an able and carefully prepared paper on "Public Service," a vast subject, he said, which presented an interesting problem in economics to the competent engineer. Mr. Comstock spoke of rate regulation, service and equipment, touching lightly on the local public service interests and the improvements which are being evidenced.

George A. Damon, dean of Throop Polytechnic Institute, Pasadena, followed Mr. Comstock, and noted extensively upon the financial aspects of the public-utility question, such as over-capitalization, under-capitalization, the appropriation of funds derived from stock and bond issues and surplus earnings, the valuation to be considered in the purchase of public-service properties by a municipality, and the amount to be allowed for development work. Mr. Damon also made slight mention of B. J. Arnold's work in Chicago.

Addresses were made by Prof. C. L. Cory, University of California, upon the subject of service versus rates, showing that the latter being consistent therewith, the former was by far the most important to the average citizen, and by R. H. Ballard, of the Southern California Edison Company, Los Angeles, who defined a "corporation" and its particular being and province in a fair-minded manner.

O. H. Ensign, chairman of the local section, presiding, and Frank H. Olmsted, engineer, also spoke briefly upon the subject. The next regular meeting of the local section will be held on January 16, when papers on the subject of "Illumination" will be presented by S. B. Lewis and E. Y. Porter. A.

Nova Scotia Power Companies Unite.

A merger has been completed between the company that controls the waterpower on the Mersey River, estimated to be 25,000, and the company on the Gaspereau River, with 5,000 horsepower. Both companies have charters from the Nova Scotia Government, with authorized capital of $5,000,000 each. The capital under the merger will be $6,000,000. The people directly interested in the merger are Sir Frederick Borden, R. A. Robert and J. W. McConnell, Montreal; Hon. B. F. Pearson, F. B. McCurdy, M. P.; John R. MacLeod, Halifax, and Frank Stanfield, M. L. A., Truro. The merger includes the taking of the Halifax Electric Tramway and the MacLeod pulp and paper mills on the Mersey River. The company proposes to transmit power for lighting and power purposes.

Doherty Company Purchases Texas Property.

Announcement has been made that the stock of the Brush Electric Light & Power Company, sold on October 31 by the Galveston shareholders to Isidore Newman & Son of New Orleans, as trustees, for approximately $700,000, had been purchased by Henry L. Doherty & Company, of New York. The Brush Company operated in Galveston.

New Electrical and Mechanical Apparatus and Appliances

Addition to Generating Station of London County Council Tramways.

What is known as the London County Council Tramways consists of what was formerly a number of independent tramway undertakings operating within the County of London, together with certain new lines subsequently built by the Council. Each of these companies owned from 4 to 50 miles of line, but gradually the Council has taken over by purchase all the tramway companies within its area. The first transfer took place in 1895 and the last in 1909. At the end of March, 1910, the system extended over 135.5 street miles, of which 115.5 miles were electric lines. The remaining 20 miles were at that time still worked by horse traction, but the latter have now practically all been converted to electricity.

The electric generating station for the whole of London is situated at Greenwich, close to the River Thames. It was erected in two sections, and the site covers an area of approximately 3.75 acres. The plant includes four vertical, horizontal, reciprocating engines coupled to three-phase alternators, of 3,000-kilowatt capacity each, and four three-phase turbo-alternators of 5,000-kilowatt capacity.

Two of the latter have only recently been installed. They were manufactured by the British Westinghouse Electric & Manufacturing Company, Limited, of Trafford Park, Manchester. One of these sets appears in the foreground of the accompanying illustration.

The two sets each comprise one 5,000-kilowatt, 750-revolutions-per-minute high-pressure Westinghouse impulse-type turbines coupled to one 5,000-kilowatt three-phase 6,600-volt, alternator, complete with Leblanc surface-condensing plant and Leblanc auxiliaries.

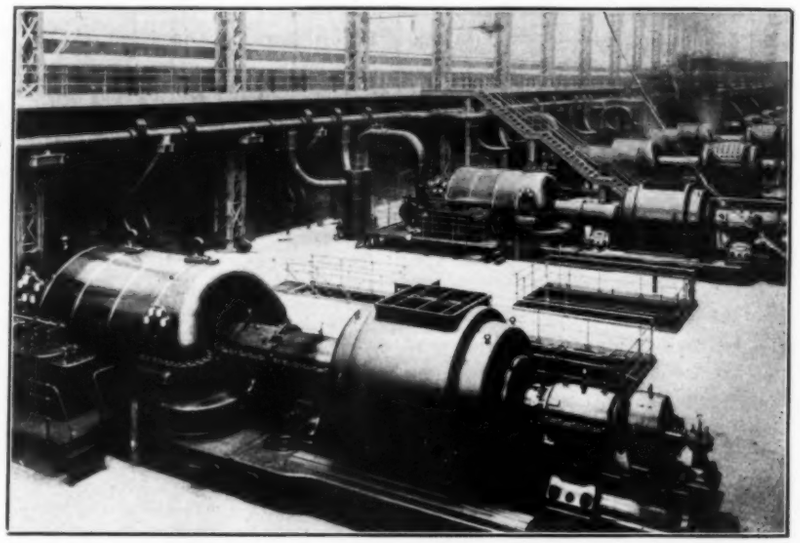
The official tests of No. 7 turbine took place on January 8, 11 and 13, 1911, after it had been eight months in regular service, with the results given below.

The guaranteed conditions were: Steam pressure, 180 pounds per square inch with 120 degrees, Fahrenheit superheat, vacuum 28.5 inches (barometer thirty inches).

	25% Over-Load.	Full Load.	¾-Load.	½-Load.	¼-Load.
Test Load in kws.	6,150	5,165	3,840	2,572	1,297
Guaranteed Consumption		14.5	14.75	16.0	19.5
Consumption Obtained 14.74		14.30	14.60	15.67	19.31

This turbine has recently been opened for inspection after having been in operation for over twelve months, and it is found that the closest examination shows no trace whatever of erosion or corrosion, the blading being perfectly clean.

The normal plant capacity of the Greenwich generating station is 34,000 kilowatts. The current is generated at a pressure of 6,600 volts, and is conveyed to various substations over the tramway area.



NEW TURBO-GENERATORS, LONDON COUNTY COUNCIL TRAMWAYS.

The substations are provided with motor generators and rotary converters of a total capacity of 45,750 kilowatts, transforming the current from alternating to direct at a pressure of from 550 to 600 volts.

The current is sent in the usual way from the low-tension switchboard through feeder cables which feed into the conductor rails in the conduit at half-mile intervals. On the overhead wire section the usual feeding arrangements for trolley wires are in use. The switches on the feeder panels in the substations allow of the conductor bars in the conduit being changed so that either may be positive or negative as required for the purpose of dealing with leakages to earth.

Ohio Brass Company Effects New Agency Arrangements.

On January 1, 1912, the agency agreement for the sale of O-B overhead materials, rail bonds and car-equipment specialties, which has been in force between the Ohio Brass Company, of Mansfield, O., and the Pierson-Roeding Company, of San Francisco, for a number of years, terminates, and will not be renewed, as it was mutually agreed that separate agency agreements for O-B Hi-tension insulators and O-B electric railway equipment would eventually prove unsatisfactory and that the interests of all concerned would be better served by a single agency for the entire O-B line.

On and after January 1, 1912, the Holabird-Reynolds Company, of San Francisco, which, for some time past, has been acting as exclusive agent for O-B Hi-tension insulators only, will become the exclusive agent for the Ohio Brass Company for the sale of its entire line in the State of California.

The Holabird-Reynolds Company will carry an adequate stock of O-B

railway materials and Hi-tension insulators at San Francisco. Business in Los Angeles and the southern part of the State will be handled by H. C. McCutchan from its Los Angeles office, under the personal direction of R. D. Holabird.

The business in the states of Washington, Oregon, Idaho and in British Columbia will be in charge of the Ohio Brass Company's own personal representative, F. V. Cook, who will make his headquarters in Seattle, at the office of the Holabird Electric Company. An intimate and friendly business connection between that company and the Ohio Brass Company will be maintained because of their California agency for O-B materials. Arrangements are being made to carry an emergency stock for quick delivery in Seattle.

Every effort will be made to handle all orders and inquiries in a way eminently satisfactory to Pacific Coast customers from every standpoint.

New Inverted Luminous Arc Lamps of High Illuminating Efficiency.

Seventy-six inverted luminous arc lamps of a new type were turned on in New Haven, Conn., on the evening of December 15, flooding Church and Chapel Streets with white light and making New Haven a city with a real white way. The cutting into service of these lamps was attended with appropriate ceremonies and was witnessed not only by the citizens of New Haven, but also by prominent lighting experts and by visiting delegations from several large cities. The decorations throughout the city were very attractive and artistic, and a monster parade was a feature of the celebration. It is estimated that 100,000 people were on the streets.

The lamps installed at New Haven are inverted series luminous arc lamps combining high illuminating efficiency with adaptability to ornamental lighting. They were manufactured by the General Electric Company, Schenectady, N. Y.

The lamp casing constitutes the capital of the supporting post or column and is so designed that by releasing a latch it may be lowered to give free access to the lamp mechanism as readily as the similar operation is accomplished on an ordinary arc lamp.

Within the base of the pole an absolute cut-out is placed so that the trimmer may disconnect the lamp from the line before starting to work on it.

In operation and design the mechanism is essentially the same as that of the standard mechanism of the direct-current series luminous arc lamp of which more than 75,000 are now in operation. The arc is struck between a stationary non-consumable copper upper electrode and a movable magnetite lower electrode burning under normal updraft conditions. A single side rod supports and carries the electrode, fume dome and chimney.

The lamp is equipped with a diffusing globe that is unique in design in that it is perfectly filled with light and no circular shadows are cast upon it by the electrodes. The globe may be removed without disturbing the alinement of the electrodes. A large ash pan is provided which is easily removable. By using the new specially designed diffusing opal globe which furnishes a beautiful secondary source of pearl-white light of high efficiency and low intrinsic brilliancy, it is possible to place the lamps at the extremely low height of 14.5 feet without producing glare.

NEW HAVEN ARC-LAMP STANDARD.

American Engineering Company.

Announcement is made of the consolidation of Williamson Brothers Company, of Philadelphia, and the American Ship Windlass Company and Taylor Stoker Company, formerly of Providence, R. I., under the title "American Engineering Company," with works and executive offices at Philadelphia, Pa.

The first steps in this consolidation were taken when in 1906 Williamson Brothers Company purchased control of the American Ship Windlass Company with the intention of gradually combining the business of the two concerns in the line of marine products.

The Taylor stoker, invented by the late E. E. Taylor, and now exclusively controlled by the American Engineering Company, was originally built in the plant at Providence, but as the time went on both the marine and the stoker business at this plant grew so rapidly that it became necessary to transfer the marine business to Philadelphia in order to give more room for both branches of the work. But hardly had this division been made when the stoker business itself began to outgrow the Providence plant. As it was impracticable to increase the capacity of this plant without entirely rebuilding the decision was soon made to build additional shops at Philadelphia and consolidate all the various departments of the business under one head at that point.

Simplex Surface Contact Equipment.

In a paper read before the Pennsylvania Street Railway Association at its meeting in Harrisburg, Pa., the development and operation of the surface-contact system was described by S. R. Hipple.

Following some preliminary work the experimenters equipped a piece of track with solid brass boxes, carefully insulated with fibre. The interior of the box was made up of two iron pole pieces, carefully machined and adjusted to the lid with a rotary armature, to which was attached a movable brass contact, which perfectly aligned each time with the corresponding contact surface attached to the feed wire. This did away with any adjustment on the part of employees when installing the box. The brush holder, attached to the feed wire, was made of brass to which was attached a carbon brush. This brush holder was fixedly placed in the box. It will thus be seen that the movable mechanism was reduced to the armature. The feed wire was enclosed in conduit and was connected to the contact boxes through a junction box, which was filled with a sealing com-

pound thereby making it absolutely waterproof. The road bed was then filled up with cinders to the height of the boxes.

The car was equipped with six magnetic coils, each wound with twenty pounds of No. 19 cotton-covered wire. These coils were enclosed in a thin copper shell, perfectly sealed, to exclude water. Three coils were placed at proportionate distances on each of two pieces of Norway iron, twenty feet long, two inches wide and an inch thick. These two pieces of iron, holding the coils or magnets, were then suspended from the car by wooden connectors, which terminated in iron rods and were bolted to the motor case. In addition to this, a bridge made up of five-eighth-inch wrought-iron rods, connected the extreme ends of the bars and

FIG. 1.

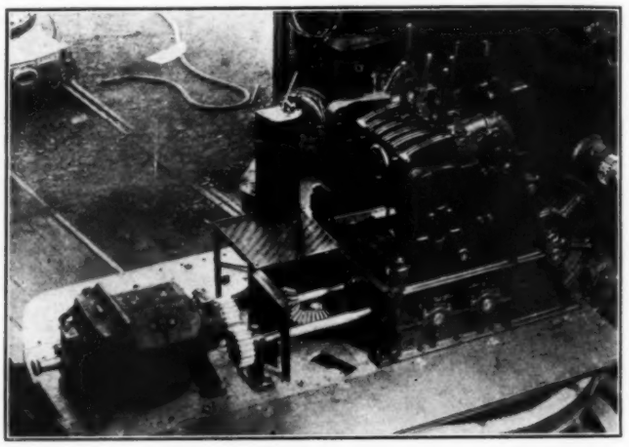


FIG. 2.

was adjusted by turnbuckles just beneath the floor of the car.

The above equipment increased the magnetic efficiency of the device fully seventy-five per cent. The magnet coils, it should be stated, were energized by a wire connected to the collector shoe, which is a copper strip, affixed between the magnetic bars. This collector shoe is so arranged as to permit a perpendicular movement of about three inches.

The equipment just described was in service from April 7, 1909, up to about the first of June, 1910, and was kept in service about eight hours per day.

Later experiments led to the use of a concrete box instead of the solid brass box described. This concrete box is made up by a special method, which gives an absolutely waterproof box, one that is non-conductor and will stand a crushing strain of 2,500 pounds to the square inch, sufficiently heavy and substantial for the purpose for which it is intended. This box is re-inforced with iron rods, and has been subjected to weather conditions, such as had for the past year and a half, without showing any indication of deterioration.

The present Simplex equipment on the Pennsylvania Railroad is very much as has been described—a concrete box, placed about every ten feet in the center of the track, and bolted to the ties; a copper strand, paper-covered, lead-sheath cable, enclosed in a 1¼-inch conduit of iron, connecting each box, and the terminals of the boxes, where the cable is connected, sealed with a weather-proofing compound. The car is equipped in the manner already described, with the addition of a small one-eighth-horsepower hand generator at each end. To the generator is attached a small hand magnet, which enables the motorman to pick up the current at any point on the line, in the event that the current should be cut off at the power plant. There is also a switch in the car, by means of which the current can be cut out of the car altogether, at pleasure, for purposes of repair.

Single-Motor Self-Propelling Crane.

The accompanying illustrations show a self-propelling single-motor railroad crane which is a very simple, economical and efficient machine for the lighter operations required of this class of machinery. Because of these advantages it is rapidly finding a place in the equipment of many factories and yards which have only a limited use for cranes and hoisting apparatus.

The machine shown in Fig. 1 is known as the Browning Engineering Company's standard No. 4 four-wheel locomotive crane. This particular machine was supplied to the Wisconsin Coal & Dock Company for use in loading coal from storage piles to cars in its yards at Superior.

It is operated as a crane and propelled by a motor, which is controlled by one man. It has a maximum lifting capacity of fifteen tons at ten feet radius and 2.5 tons at forty-foot radius. The working weight is approximately thirty-five tons. The draw-bar pull of this machine is about 7,600 pounds which enables it to handle six or seven cars on a level track.

The motor is Westinghouse direct-current make, built especially for crane service. It has a heavy frame horizontally split so that all the parts are easily accessible. The shafts are extra large and strong and the area of the commutating surface ample for good commutation. The current density in the brushes is low. High starting torque and low fly-wheel effect permit the quick starting, stopping and reversing required by the service. The motor shown is rated at 50 horsepower, 220 volts, 470 revolutions per minute.

Fig. 2 gives a detail view of the motor connections and the mechanism in general. Standard reversing drum-type Westinghouse controller and grid resistors are used for controlling the motor.

W. Spilhaus & Company, the well-known merchants of Cape Town, South Africa, have applied to that municipality for a concession to construct an aerial railway up Table Mountain, the motive power to be electricity.

"Built-in" Magnetos for Gas Engines.

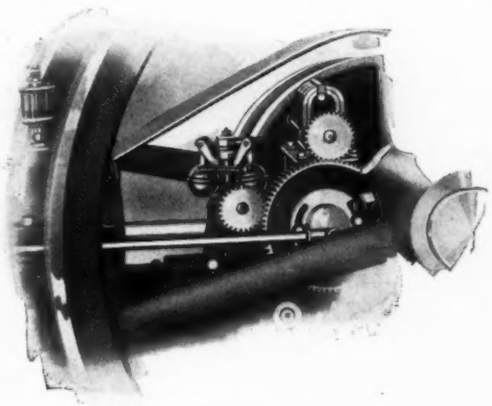
The Foos Gas Engine Company has abolished batteries on all of its standard-type engines and hereafter will use a magneto for running as well as for starting. This announcement is especially significant in showing the utmost reliance in its new magneto and the Foos wipe-spark igniter. The success obtained therewith is decidedly worthy of thorough investigation into its mechanical and electrical features. It is said that this is the first American engine to embody a "built-in" magneto in its design.

To start with, the Foos Gas Engine Company had an ignition system as follows: A wipe-spark igniter theoretically belonging to the widely adopted class of "make-and-break" igniters used on stationary engines. In mechanical construction and operation it has many exclusive characteristics. Instead of the customary "hammer" action of make-and-break igniters, the Foos electrodes are only in frictional contact through the wiping action of a revolving blade. The factory claims that the sparking surfaces wiped clean during each impulse would render it impossible for the igniter to foul. Furthermore, it would be easier on batteries on account of short contact and a larger spark could be secured with less voltage. The manufacturers, therefore, considered that this igniter was ideally adapted to a low-voltage, slow-speed magneto if it were possible to break the lines of force and secure a high potential that would make a hot spark while turning an engine by hand.

In its comments on the electrical efficiency of the magneto the company claims the following advantages; voltage and current properly proportioned so that igniter contacts are not burnt out, and in fact act better with magneto than with battery; battery, coils, timers, switches and much wiring eliminated; the mechanical equipment further simplified by not having commutator, brushes or field coils. Friction wheels and speed governors are not needed as the magneto is positively driven at the same speed as the engine and geared directly from the crankshaft.

This magneto is especially noteworthy on account of the size and number of its magnets. They are made from tungsten steel and consist of a set of six, each one five-sixteenths by one and one-half inches. The base is solid with holes in the end plates to prevent them from getting stopped up. Each magnet is securely bolted to the pole pieces, using special screws accurately ground to fit.

The armature is laminated, consisting of many pieces of special soft sheet iron. The armature housing is particularly strong and rigid and cannot distort or change its shape in any way. The armature windings are made from the best grade of double-insulated wire; the winding space insulated with special fabric impregnated with an insulating compound. Unusual precaution is taken to make the armature coil, oil and moisture proof. The result of this construction insures a machine of great rigidity in which there are no loose pieces. The collectors for bringing out the current bear on smooth, polished-steel surfaces.



FOOS "BUILT-IN" MAGNETO.

The Foos magneto produces an alternating current—therefore having two "peaks" for each revolution of the armature. During the rest of the revolution the current is too weak to produce a spark. The relative position of the two peaks is fixed and synchronized by driving the magneto positively and setting the armature in proper relation to the engine. As it is well known that a magneto should never be driven at high speed, and that belts, friction wheels, speed governors, etc., are unreliable and inefficient, the success of the Foos engine will make an interesting incident in gas-power engineering.

Magnetos have not been favorably considered heretofore because they had not been designed with electrical efficiency high enough to generate a hot spark at slow speed nor while starting up. How it has been accomplished by the Foos factory is not covered by available information. To gas-engine buyers the important fact is that this result is guaranteed by such a prominent factory that it has sufficient confidence in the magneto to ship out large engines without batteries.

Boiler Tests of Coal Quality Inadequate.

That some owners of power plants have rejected the plan of buying coal on the basis of its heating value because their own boiler tests were unfavorable, is perhaps better known than the facts which have misled the judgment of such owners.

In discussing this matter, D. T. Randall and Perry Barker, of Arthur D. Little, Inc., chemists and engineers of Boston, point out the many elements of adaptability, or the reverse, of the boilers used in a boiler test, and the great variations in results due to the fireman himself. They show that a boiler test is a rather crude method of comparing coals, especially if the fireman is not accustomed to burning the coal to be tested, while a chemical laboratory test, that is conducted under conditions which may readily be duplicated, gives results that are much more reliable.

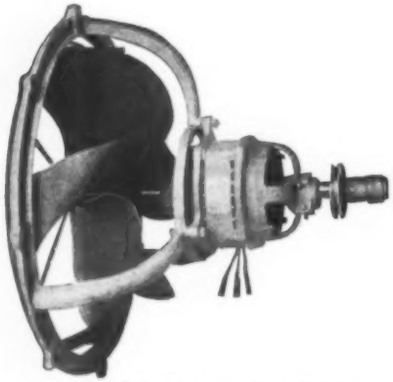
Occasionally owners of power plants have purchased for testing purposes a coal of higher grade than they usually furnish for the boiler furnaces. The results obtained have often been disappointing and without further investigation they have declared that the plan of purchasing coal on the basis of its heating value is at fault, and that corresponding results can not be obtained from the higher grade coals. On the other hand it has happened that others have tried coals of lower heating value than the coal regularly burned in their plant, and they often find a greater drop in the evaporation than they expected. This has led many people to believe that there is a great difference in the value of coals for only slight variations in composition.

In a recent paper before an English engineering society Dr. Robert Pohl advocated standard ratings for motors and generators. The scheme suggested covered questions of rating, performance, temperature rise and pressures.

Variable-Speed Induction Motor for Fan Service.

Where the employees of offices, factories and shops are required to work together in the same room, the cheerfulness, health and efficiency of the working force will depend to a large extent upon an abundant supply of pure air. To obtain this, it is usually necessary to install proper ventilating apparatus, the small expense involved being amply compensated for by the increase and betterment of labor performed under hygienic conditions.

The General Electric Company has recently placed on the market a new line of polyphase variable-speed exhaust sets having a simplified method of speed control, and admirably adapted to ventilating service. These sets employ a very simple method of speed



VARIABLE-SPEED FAN MOTOR.

control, the rotor and shaft being shifted longitudinally so as to bring windings of different characteristics into the magnetic field of the stator. The high-speed winding consists of a squirrel-cage low-resistance rotor, and extension of the spider supporting a cast-iron ring which constitutes the low-speed rotor.

The motor frame is of the standard riveted-frame type, the field flanges having cast ears provided for attaching the supporting tripod. The shaft is extended at one end to permit mounting the fan, while the opposite end has a thrust adjustable along the axis of the shaft. An adjusting rope wheel is mounted on the extended shaft, this wheel being threaded to an extended portion of the opposite fan-shaft bearing. Maximum speed is secured by rotating the wheel, by means of the adjusting rope, to the extreme right, the opposite limit of travel giving the minimum speed.

Fifty-per-cent speed variation may be obtained at high efficiency, the actual power taken from the line being reduced approximately in direct ratio to decrease in speed. The fan is made in 18, 24, 30, 36 and 42-inch sizes.

News and Trade Papers in Foreign Countries for Advertising Purposes.

Advertising in some form is recognized as an essential factor in every effective trade-getting campaign in this country, and this is to a considerable extent true in foreign markets. Most American manufacturers, although familiar with the style and cost of advertising at home, do not have such information regarding foreign countries.

In order to furnish those engaged in or desirous of entering the foreign field a general idea of the cost of newspaper advertising abroad and the papers it might be advisable to use, the Bureau of Manufactures, of the Department of Commerce and Labor, is publishing in *Daily Consular and Trade Reports* a series of reports by American consular officers on foreign news and trade papers. The reports embrace such points as location and class of paper, district covered, circulation, subscription price, and advertising rates.

The list for England, which included the papers in fifteen districts, appeared November 27. Lists for South American countries are in course of preparation and will be published at an early date. The series, when completed, will cover all foreign countries.

Steam Road to Try Storage-Battery Car.

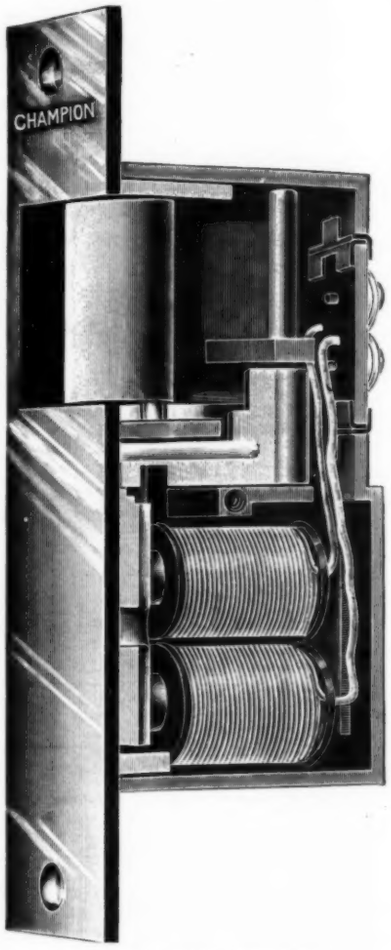
S. M. Felton, president of the Chicago Great Western Railroad, has announced that a thorough test will be made by that road of a new storage-battery passenger car using the Edison battery. One of these cars will be put in operation on a branch line. It is thought that a modification of this storage-battery car can be used for switching purposes in the terminal freight yard in Chicago and aid greatly in eliminating the smoke nuisance.

Electric Railway in Russia.

A concession has been granted for the construction of an electric railway 69.5 versts in length in the province of Moscow, the city of that name being one terminus. This railway will be built without any State guarantee, such as is common for steam railroads in that country.

Champion Door-Opener.

The Standard Lock Company, Brooklyn, N. Y., is manufacturing an electric door-opener. It is said to require very small current for operation, thus helping to prolong the life of the battery supplying current. It operates very easily, even with 100 pounds pressure against the revolving bolt, but no forcing or jolting will open it unless current is applied. The construction is



CHAMPION DOOR-OPENER.

extremely simple, as shown in the accompanying illustration. Every opener is carefully tested before leaving the factory and will operate with 0.3 ampere under ten pounds pressure. Its resistance is 0.83 ohm, and consequently the drop in its windings is about 0.25 volt.

There are now over 25,000 of these door-openers in use. They are handled in Chicago by the William P. Crockett Company and the coast trade is looked after from headquarters in San Francisco by the Aylsworth Agencies Company.

New Type of Electroplating Dynamo.

A new type of low-voltage dynamo suitable for electro-plating and electrolytic work has just been brought out by the Munning-Loeb Company, of Matawan, N. J. These machines which are known as Optimus dynamos, embody many novel features which will be of interest to practical electro-platers.

Except in the smaller sizes, Optimus dynamos are of the multipolar type, thus securing a much better magnetic distribution and higher efficiency than is possible with the bi-polar type.

The Optimus dynamo is compound wound and extensive tests that have been made show that these dynamos give a practically constant voltage from no load to twenty-five per cent overload. This constant line voltage is automatically maintained by means of a special compound winding, and is not secured by any manual shifting of field rheostats. This uniform voltage characteristic makes it possible for the plater to throw different tanks in and out of the circuit at will, without having to worry about it affecting the voltage of the dynamo. There is thus never any danger of burning the edges of the work due to short periods of high voltage, nor is the work necessarily retarded by slow deposition of metal due to low voltage.

The compound winding also maintains a fixed neutral position for the brushes on the commutator so that sparkless commutation is secured without shifting of the brushes with changes in load.

The brushes are made of a special carbon composition and are held against the commutator by means of an adjustable clock spring. A flexible braided-copper cable carries the current away from the brushes and thus provides a constant contact instead of the sliding contact so often depended upon. These brushes bear radially upon the commutator and it is claimed that they can be used for their entire length and that they will not score or cut the commutator as usually happens when copper-gauze brushes are used. Furthermore the fact that the carbon brushes bear radially and not tangentially insures that they will always remain at the neutral point. When a brush bears tangentially and the end is gradually worn off, it keeps moving back further and further on the commutator and if sparkless commutation is desired, it has to be shifted forward occasionally.

The Optimus plating dynamo is wound for either two or three-wire circuits. They are also furnished in all sizes from 300 to 50,000 watts.

The manufacturer of the Optimus dynamo are also making a special feature of a direct-connected set, and can supply any size plating dynamo, directly connected to any type of alternating or direct-current motor, mounted on the same bed plate. As both the motor and generator are designed and built by the same company, it is claimed that the driving motors are designed so as to have characteristics which will most advantageously fit in with those of the dynamo. It is claimed that this unity of design results in a high overall efficiency of these sets, and that installation costs, such as lining up two machines, providing foundadations, etc., are greatly reduced.

Hydraulic Testing Versus Visual Inspection of Boilers.

We have on more than one occasion deprecated undue reliance on the hydraulic test as a means of detecting defects in steam boilers, though there has been a tendency for inspecting companies during recent years, owing to the importance attached to such tests by Board of Trade Commissioners at formal inquiries into boiler failures, to resort to them more frequently. Inspecting authorities can hardly be blamed for this attitude. It is one they would probably not adopt spontaneously, and have only pursued because the application of a hydraulic test deprives the Commissioners, in the event of a failure, of a ground of complaint upon which they have been, in our opinion, too ready to stand. In saying this we do not underestimate the value of the test or deprecate its use in cer- as a substitute for visual inspection. tain cases. It may be, and often is, the only means of getting information respecting the strength of new structures or the working condition of old ones, and the former of these functions is probably the more valuable, and its uses for the latter purpose may occasionally be both justifiable and necessary, but it should be as an aid and not whenever possible. Unless this is kept in mind the resistance of a boiler to a hydraulic test may give rise to a belief in its sufficiency not warranted by the facts. Instances of this kind have repeatedly come under our observation, and some further illustrations culled by Michael Longridge from the experience of his company in connection with boilers submitted to inspection are given in his annual report for the year 1910. In one case a vertical boiler offered for sale was found, when examined on behalf of a would-be purchaser by one of the company's inspectors, to be in so bad a condition that it was only fit for the scrap heap, and yet the seller offered it as "a good boiler," in genuine faith that it was fit for work, since it had sustained a hydraulic test of 100 pounds on the inch. Although the wasted portions which rendered the boiler dangerous were visible at a glance, they were of too local a character to yield to the hydraulic pressure applied, and had reliance been placed on that test alone disaster might easily have resulted.

The following facts of another case are equally instructive. A Babcock & Wilcox boiler of unknown age, and working at 60 pounds, had the mud drums renewed in 1909, and the boiler tested to 100 pounds on the inch. In the following year some new tubes were inserted and the boiler again tested to 120 pounds by water pressure, when there was some leakage from the seams of one of the upper drums. "The inspector, not feeling satisfied, had the brick covering stripped off the drums, and then found both corroded nearly through. The wasted surfaces were between the pipes leading to the steam dome and the back end of the drums, and their areas were about one square foot. The thickness varied from one-sixteenth of an inch to that of brown paper, and yet the drums withstood a water test of 120 pounds per square inch!" As evidence of the attenuated condition of the plate, a photograph is appended to the report, and it certainly does seem amazing that a piece of plate so thin should have been able to resist the test pressure imposed, but the fact remains that it did. It certainly would seem as if a special providence sometimes watched over careless boiler owners. Another case is mentioned where a portable boiler of unknown age was proposed for insurance and found so thin in the firebox near the grate level that the inspector could pierce the plate with his chisel. The boiler, it is added, was worn out beyond repair,

and "by every rule or formula relating to the strength of boilers ought to have exploded." As a set-off to such fortunate escapes it should be remembered that numerous instances could be quoted where boilers have blown up just when they were on the point of being pulled out, and disaster has been the price of working them a day too long. As the hammer test as a means of detecting a thin plate is sometimes, like the hydraulic test, worshipped a little too blindly, it may be convenient to quote a case from the report which illustrates the danger of this attitude. It seems that the company refused to certify a certain Lancashire boiler until some brickwork—rendered damp by leakage from an overhead tank—had been removed and the plates in contact with it examined. "After a long dispute the brickwork was taken away and the examination made, when five of the eight rings of which the shell was composed were found to be corroded from one-eighth to three-eighths of an inch deep over large areas. The owner was then asked to strip the boiler entirely, but this he refused to do, stating that after the first five corroded rings had been repaired he could get plenty of people to certify the boiler." The company's connection with the boiler, it is stated, then ceased, a not unusual consequence of an honest, if unpleasant, opinion, as inspecting authorities know. The point, however, to which we wish specially to draw attention is that unless precautions are taken it is easy to be deceived by the hammer test. A thin plate cannot always be detected by its sound when hammered, and an inspector who does not detect a thin plate in this way is not necessarily incompetent. If, for example, the plate is in contact with solid brickwork, then a thick and thin plate will sound very much alike. The inspector in the case in question could not tell by hammering whether the plate was thin or not, and had to have the brickwork stripped off it before he could find out the defects.—*The Mechanical Engineer.*

New Street Lamps for Wilmington.

Wilmington, Del., has decided to change its arc street-lighting system to one in which ornamental standards with tungsten lamps and white globes will be used. There will be 172 new incandescent lamps to replace the eleven former arc lamps along Market Street.

Cost of Anthracite Coal.

Anthracite coal was at one time an important factor in blast-furnace practice, but for this purpose it has been almost entirely supplanted by coke made from bituminous coal. The principal future demand for anthracite will be restricted largely to domestic trade, for which the sizes known as furnace, egg, stove, chestnut, and pea are required.

The breaking down of the lump coal, which was formerly a marketable product, for the preparation of the domestic sizes, results in an increased proportion of the small or undesirable sizes, all of which are sold at less than the cost of production. The proportion of these small sizes has increased from 23.1 per cent in 1890 to 41.6 per cent in 1910, while the proportion of sizes larger than pea coal, or what may be termed the profitable sizes, has decreased from 77 to 58.4 per cent. The price of anthracite coal at the mines in 1910 averaged $2.13 per long ton. All the profits on the mining operations must be obtained from the prepared domestic sizes, for the revenue obtained from the smaller sizes, which are sold largely in competition with bituminous coal for steaming purposes, serves only to reduce the cost of the domestic sizes. The conditions under which the anthracite mines are operated, the greater depths to which the workings are carried, the consequent increased expense of mining, and the increasing cost of labor, all contribute to make anthracite fuel more and more a luxury. Prices must advance in accordance with the increasing cost of production.

Uses of the Electric Motor in Concrete Construction Plants.

The kind and amount of power to be used by any concrete-construction plant depends upon the various conditions of the job and the ultimate selection of the drives should be made only after a careful consideration of all the elements entering into the cost. Individual jobs are sometimes more alike than would be first supposed, and for this reason the remarks made by Morton C. Tuttle, of the Aberthaw Construction Company, Boston, are of interest.

The Aberthaw Construction Company has used steam, electricity, and gasoline but discarded the gas engine a few years ago, primarily because of the independability of the engines used and also because it was difficult to secure in every case a firm base for the engine. The steam engine equipment they have found has distinct advantages at times, such as cold weather concreting when it is necessary to heat the materials and often thaw around a job.

However, this company prefers electricity when it can be obtained, for the following reasons: (1) The power required on a construction job being intermittent, the saving made when the motor is not in use is considerable; (2) the power is always available on a moment's notice; (3) the motors are portable, easily set up, require small housing, and very little attention; (4) electricity can now be obtained at reasonable figures and the former large expense involved in carrying motor equipment enough to drive with the different types of current used in different cities no longer exists as most power companies rent motors on a reasonable basis.

As to the motors used it may be said that the Aberthaw Construction Company's custom is to arrange its standard four-bag mixer and belted hoist in one group and drive by a twenty-five-horsepower motor. The saw mill containing a split saw, planer, a pendulum cut-off saw, boring machine, and grinder are regularly driven by a ten-horsepower motor. For material elevators a fifteen-horsepower motor running continuously with a belt shift which is operated by a rope is used. Where the sand bins have been loaded from a track boot a five-horsepower motor is generally used to run the conveyor equipment. To operate a concrete hoist a fifteen-horsepower motor is commonly installed if there is one bight in the line. Direct-connected hoists are operated by twenty-two-horsepower units. On the hoist which operates the dump bucket the Aberthaw Construction Company has an additional drum which operates the boom placed on the corner of the concrete tower. For driving its standard mixer which is a four-bag machine, twelve-horsepower motors are usually set up, but these mixers have been driven with as little as 7.5-horsepower each.

Tungsten in Ontario.

It is reported that scheelite, an ore from which tungsten is obtained, has been discoveed in northern Ontario. E. G. Rognon is credited with this find.

Current Electrical News

COMMISSION NEWS FROM NEW JERSEY.

(Special Correspondence.)

Hearing was held on the petition of the Interstate Telephone & Telegraph Company for approval of an issue of $1,525,000 bonds. This approval was objected to by Alan H. Strong, Esq., who appeared before the Board representing ownership of five of the general mortgage gold bonds of the denomination of $1,000 each, of the Interstate Telephone & Telegraph Company, also representing ownership of certificate of beneficial interest for forty-nine shares of the capital stock of the Interstate Telephone & Telegraph Company of New Jersey.

Hearing was called on the application for approval of agreement of merger and consolidation of the Lambertville Gas Light Company and the Flemington Gas Light Company to be known as the Hunterdon County Gas Company.

The Board met on Friday, December 22, 1911, at Jersey City to hear the complaint of the mayor and Alderman of Jersey City vs. the Public Service Railway Company in regard to fare limits established by the company, also a complaint alleging annoyance to passengers and people residing along the line of the Company because of the existence of flat wheels.

On Tuesday, January 2, the Board will hear the complaint of the Township of Bordentown vs. the Riverside Traction Company referring to refusal of the company to comply with what is claimed is a legal obligation, to provide transportation for school children at a reduced rate of fare and to provide free transportation for certain Township officials.

The Board will hear the complaint of the Maple Shade Improvement Association vs. the Public Service Railway Company, regarding rates of fare charged between Camden and Maple Shade, a distance of 7.4 miles, it being alleged that the charge of ten cents is discriminatory.

Wednesday, January 3, the Board will continue, at Newark, its investigation into the reasonableness of rates charged by the Public Service Gas Company.

On Friday, January 5, the Board will hear the complaint of Edward J. Dusel, et al., vs. New York Telephone Company, in regard to alleged failure to supply service in the Borough of Dunellen. The Board will also, on this date, hold a hearing on a new schedule of fares involving certain changes proposed by the Central Railroad of New Jersey.

INTERSTATE COMMERCE COMMISSION NEWS.

(Special Correspondence.)

The Interstate Commerce Commission has issued a circular to the telephone companies deferring the use of the uniform system of accounting, which was to take effect January 1. The circular, under the signature of Charles A. Lutz, chief examiner of accounts, is as follows:

Accounting series circular No. 30, dated November 15, 1911, containing a tentative uniform system of accounts for telephone companies, subject to the act to regulate commerce, invited criticisms and suggestions from those interested and stated that it was the intention of the Commission to have a uniform system of accounts issued under order as effective on January 1, 1912. Many valuable criticisms and suggestions have, in consequence, been received, which require time for further careful study and consideration before a system of accounts is prescribed that may be best adapted to the purposes of all parties concerned. It has, therefore, been determined that the proposed system of accounts will not be made effective on January 1, 1912.

Among the more important criticisms of the tentative classifications received are such as express the need of a large number of small companies for a much simpler set of accounts than that embodied in the classifications for Class C companies, as tentatively provided in accounting series circular No. 30.

When a system of accounts for telephone companies is formally prescribed under order of the Commission the classifications will be sent to the companies, as far as practicable, in advance of the effective date to enable them to make preparations for the installation of the prescribed accounts. Any additional suggestions that telephone companies desire to offer in the meantime will be welcome.

COMMISSION NEWS FROM NEW YORK.

(Special Correspondence.)

The Public Service Commission has decided to call for bids on Section 3 of the Broadway-Lexington Avenue subway, which extends from the northern line of Howard Street under Broadway to a point midway between Houston and Bleecker Streets, with a station at Prince Street. Bids will be opened on January 11.

Following correspondence with the Public Service Commission, Second District, the Western Union Telegraph Company has advised the Commission that arrangements have been completed for the delivering free of messages within corporate or municipal limits in the state of New York, including the large territory comprising Greater New York. In the outlying boroughs, however, the company will not undertake to make deliveries at any hours of the night when the local offices serving those boroughs are closed. In its letter to the Commission the company states that it believes that this move on its part will be a long step in advance and will do away with a certain amount of dissatisfaction attendant upon extra delivery fees. The company further expresses the hope that the action will be justified by an increased satisfaction to the public since the additional expense to the company is heavy.

IMPORTANT DEVELOPMENT

(Special Correspondence.)

MONTEREY, MEX.—Further details of the plans of the Compania Hydro-Electrica Mexicana for the installation of hydroelectric plants and the construction of power transmission systems in Northern Mexico have been made public here. The concessions which the company has taken over give it the right to utilize the water of the Rio Blanço in the states of Tamaulipas and Nuevo Leon and of the Rio de los Naranjos in the San Luis Potosi for the development of electric power. The company, which has a capital stock of $15,000,000, is now having surveys made preparatory to beginning the work of constructing the first two hydroelectric plants upon these streams. It is stated that the plans call for the development of approximately 75,000 horsepower. The transmission lines will be extended to cities and mining camps within a radius of 150 miles of the hydroelectric plants. This enterprise will be the means of affording cheap lights and power for the cities of Monterey, Saltillo, Tampico, Victoria, Montemorelos, Linares and San Luis Potosi, as well as a number of smaller places and thriving mining camps. It is announced that contracts have been let for hydraulic and electric works. The carrying out of the present plan will involve the expenditure of more than $10,000,000 gold, it is stated. Under the concessions held by the company from the government it has available water supply sufficient to develop more than 100,000 horsepower of electrical energy, and this full power will be ultimately reached. The officers of the company are: Thomas M. Sanders, president; Manuel Migoni, secretary; Jose Romero, comissario. D.

LIGHTING AND POWER.

(Special Correspondence.)

OAKLAND, IOWA.—The electric light plant will be rebuilt.

BOULDER, COLO.—A new system of street lighting is to be installed.

ALLISON, IOWA.—Claude Mackey has been granted a franchise for an electric light plant. C.

MENLO, IOWA.—The proposition to light the town by electric lights was carried almost two to one.

HOPKINTON, IOWA.—Milrey Brothers will construct a power dam across the Maquoketa River at this point. C.

CLARA CITY, IOWA.—Charles Bush and E. Behrends have been granted a franchise for an electric light plant. C.

WAYZATA, MINN.—The town voted bonds for an electric light and water-works system, the former to cost $15,000. C.

LINDSTROM, MINN.—The St. Croix Falls Minnesota Improvement Company will build a transmission electric station here. C.

DOWNIEVILLE, CAL.—The Brown Bear mine, operated by J. G. Jackson, plans for the installation of an electric-power plant. A.

INDIANAPOLIS, IND.—Permits have been issued for the installation of eight electric elevators in the Hume-Mansur Building.

MOGOLLON, N. M.—The Socorro Mining Company is installing an electric power plant at Mogolon, where a number of its mines are situated. D.

TUSCARORA, NEV.—The Tuscarora Mines Company, H. S. Haskins, general manager, plans to increase the capacity of its power plant. A.

McVILLE, N. D.—The Council and Commercial Club are discussing the installation of several large street lights on Main street. C.

SIDNEY, O.—The Western Ohio Electric Railway Company has secured a ten-year franchise to furnish light, heat and power in Sidney.

OLYMPIA, WASH.—The City Council plans for the construction of electric-light arches on East Fourth Street. Tungsten lamps will be used. A.

ALTON, IOWA.—The Electric Light & Power Company has been sold to the Mason Plumbing & Heating Company, who will improve the plant. C.

LAKEVIEW, ORE.—Owners of the Ramona Hot Springs near Lakeview, plan for the installation of an electric-lighting and pumping plant. A.

SIDNEY, O.—The Western Ohio Electric Company was this week granted a ten-year franchise to furnish light, heat and power in this city. H.

VISALIA, CAL.—Exeter's Board of City Trustees has adopted and advertised for sale the franchise sought by the Tulare County Power Company.

CHAMPAIGN, ILL.—This city has voted in favor of the issuance of bonds to install a $35,000 street-lighting system of incandescent lamps.

SHEBOYGAN, WIS.—S. J. Fairweather of the fire system seeks information on a five-ampere, 110-volt generator with motor for changing storage batteries. C.

KENMARE, N. D.—The Kenmare Light & Power Company is figuring on extensive improvements to the plant and service, both in the city and at the mines. C.

SINTON, TEX.—The Sinton Ice & Light Company has been formed here with a capital stock of $10,000. It will install an electric light plant and ice factory. D.

GALICE, ORE.—The Cougar Consolidated Mines Company plans for the construction of an electric-lighting plant at its property. Edward Heath is superintendent. A.

EMBREEVILLE, TENN.—The Nolachuckey Power Company is planning to install a power plant and cotton mill a few miles down the Nolachuckey River from Erwin.

MINNEAPOLIS.—The special committee orders the construction of a new street-car line on Franklin Avenue and Eleventh Street from the Mississippi River to Hennepin Avenue. C.

FALLON, NEV.—The city has been authorized to construct an electric lighting, heating and power system, to borrow $15,000 for said purpose, and to issue bonds of the city therefor.

SOMERSET, VT.—The New England Power Company plans to spend $4,000,000 in developing power on the Deerfield River. It is estimated that 120,000 horsepower will be transmitted.

ST. MARYS, O.—A fifteen-year franchise and a ten-year contract for lighting the streets has been granted to William Jasperson, of Coldwater, who has formed a new light and power company. H.

HILL, ILL.—The Stone & Webster Engineering Corporation has started work from this point on the $2,000,000 transmission line to be built from Keokuk to St. Louis. A power transmission station will be built here. C.

CENTRAL CITY, IOWA.—The Wapsie Electric Light & Power Company is building a new dam across the Wapsie River here. It is to be 200 feet long, with a wing 137 feet long. A power house will also be built. C.

OAKLAND, CAL.—The Yolo Water & Power Company has filed articles of incorporation with $10,000,000 capital stock. The incorporators are Leon M. Gove, H. L. Breed, Charles Gross, J. E. Bowes and M. S. Hamilton.

SILVER CITY, N. M.—The Mogollon Power and Mining Company has been formed here with a capital stock of $250,000. Its incorporators are Thomas J. Curran of Cooney, N. M.; R. P. Barnes and C. C. Royall, Silver City. D.

PASADENA, CAL.—General Manager C. W. Koiner of the municipal electric-lighting plant has been instructed by the City Council to purchase operating supplies, fuel oil, and construction materials to the extent of $1,500. A.

LANSING, MICH.—The State Railroad Commission has authorized the Commonwealth Power Company to issue bonds for $1,860,000. The greater portion of this money is to be expended in improvements in the various plants.

BOISE, IDA.—The plant and system of the Boise Gas Light Company has been acquired by Kelsey, Brewer & Company, Grand Rapids, Mich. The new owners are said to be planning for improvements and additions to the property. A.

SAN FRANCISCO, CAL.—Articles of incorporation have been filed with the Secretary of State by The Northern Power & Water Company, San Francisco, capital stock $25,000; F. E. Boland, C. W. Willard and H. L. Atkinson, among the incorporators.

WONDER, NEV.—The Jack Pot mine plans for the construction of a transmission line to connect with the new substation to be erected at its property. The line will be about one and one-half miles in length. E. S. Cunningham is superintendent. A.

CAMAS, WASH.—The Northwestern Electric Company has been granted an electric-light and power franchise at Camas. The company is engaged in building a dam on the White Salmon River, in Klickitat County, for a proposed hydroelectric power plant. A.

WATERVILLE, IOWA.—The Council granted a twenty-five-year franchise to the Consumers' Power Company of Mankato to construct a plant to distribute electricity for lighting and power purposes. A franchise has also been secured in Morristown. C.

GREENFIELD, IND.—The Citizens' Electric Company has been formed here for the purpose of creating current for the new ornamental cluster system of lighting. The officers are as follows: J. J. Pratt, president; Elam Leary, secretary, and Charles M. Curry, treasurer. S.

COATESVILLE, IND.—At an election held in this town the people voted in favor of issuing bonds for installing fixtures and equipment for an electric-light and power system. The current will be obtained from the Terre Haute, Indianapolis & Eastern Traction Company. S.

LOS ANGELES, CAL.—The Board of County Supervisors will receive bids up to January 15 for furnishing and installing two water-tube boilers, a vacuum cleaning plant, and heating and ventilating system in the County Hospital. H. J. Lelande is clerk for the board. A.

OTTUMA, IOWA.—The Ottuma Gas Light, Heat & Power Company has been sold to Grand Rapids, Mich., and Chicago capitalists, called the Western Utilities Company. The company will be reorganized and an issue of $750,000 bonds floated for extensions and improvements. C.

DAYTON, O.—The Montgomery County Commissioners have granted the Dayton Light & Power Company, a $20,000,000 corporation, a franchise to continue the transmission of current from Mount McKinley to Trotwood, and to furnish the latter village with electric light and power.

DEL RIO, TEX.—E. B. Chapin, San Antonio, and associates who are arranging to construct a dam across Devil's River north of here, and install a hydroelectric plant of a capacity of 60,000-horsepower, have let the contract for the preliminary surveys to C. S. Young company, San Antonio. D.

SAN FRANCISCO, CAL.—Articles of incorporation have been filed with the Secretary of State by the California-Oregon Power Company, San Francisco, capitalized at $10,000. A. L. Whittle, Mill Valley; E. Schwab, San Francisco; and E. Hohfeld, Alameda, are among the incorporators.

MANKATO, MINN.—The Consumers' Power Company is planning to run a power line through Vernon Center, Amboy, Winnebago and Blue Earth, one through Kasota and St. Peter, another one to Lake Crystal, one to Fairbault through Janesville, Easeca, Waterville and Eagle Lake, Madison Lake and Elysian.

BATTLE CREEK, MICH.—A new electric power plant costing $250,000 is to be constructed here by the Commonwealth Power Company, and work is to commence at once. The plant will be a terminal of the longest high tension in the world, running from the Au Sable River to this city, a distance of 250 miles.

OAKLAND, CAL.—Articles of incorporations have been filed with the Secretary of State by the Yolo Water & Power Company, a $10,000,000 concern formed by Oakland men. Electrical power, power sites, electrical and other energy for light and power are some of the enterprises to be engaged in by this company.

GLENDALE, CAL.—Bids will be received up to January 8 for furnishing the city with tungsten and carbon incandescent lamps, single-phase transformers, five to fifty kilowatts capacity, induction integrating wattmeters. The goods must pass inspection by the manager of the Glendale Municipal Lighting Department.

LA CROSSE, WIS.—The Wisconsin Securities Company which recently organized in Milwaukee with $1,000,000 capital is said to be interested in the refinancing of the La Crosse Water Power Company, which will soon start work on repairing the damage to its property caused by the flood on the Black River last October.

SACRAMENTO, CAL.—The State Board of Control has commenced the installation of an ornamental arc-lighting system on the capitol grounds. Seventy-four lights will be installed surmounted on iron posts. George Radcliffe is capitol superintendent. The Board will soon call for bids for about 25,000 lamps for use in the state buildings during the coming year. A.

SAN FRANCISCO, CAL.—The California-Oregon Power Company has filed articles of incorporation with a capital stock of $10,000,000 to operate in the electric-light and power business in northern California and southern Oregon. A. L. Whittle, Mill Valley, E. Schwab and F. B. Lorigan, San Francisco, J. F. Sherman, Oakland, and E. Hohfeld, Alameda, are incorporators. A.

LOS ANGELES, CAL.—The board of Public Works is advertising for bids for street lighting in the city for the coming year. The specifications provide for two proposals: lighting the 3,203 lamps at present installed; for lighting such number and an addition of 500 new lamps to be placed in service in 1912. The Los Angeles Gas & Electric Company is at present furnishing the service. A.

ATTALIA, WASH.—The Board of County Commissioners has granted an electric-light and power, and a water-works franchise to the Attalia Land Company. The company plans for the immediate construction of a transformer station, high-tension energy to be obtained from the Pacific Power & Light Company; and for the installation of a distributing system. A water-works system is also planned. A.

AUSTIN, TEX.—The Hydraulic Properties Company, New York,

which has the contract for the reconstruction of the dam across the Colorado River at Austin and the installation of a hydroelectric plant, has begun the work of erecting the building for the power house and will soon start the construction of the dam. The city has extended its electric power transmission system to the dam site to provide power for the construction machinery. D.

SAN FRANCISCO, CAL.—The Northern Power & Water Company has been incorporated with a capital stock of $25,000,000, to operate in the lighting and power business in northern California. F. T. Boland, C. F. Willard, H. F. Atkinson, A. J. McKeon and A. F. Kessel, all of San Francisco, and S. J. Langmaid, Berkeley, are incorporators. A.

ALLENTOWN, PA.—Authority has been granted the Lehigh Coal & Navigation Company for carrying into effect a great project for the generation of electric power from anthracite coal used directly at the mouth of the mine ten miles west of Mauch Chunk, and the distribution of such current over high-voltage transmission lines to industries in surrounding territory, ultimately reaching Philadelphia and New York. The project contemplates a power plant of 100,000 kilowatts capacity, to be built in sections. The initial installation will be a 30,000-kilowatt plant, which with distributing lines and transformer stations will cost about $3,000,000. A subsidiary corporation called the Lehigh Navigation Electric Company will own the plant and handle the electric-power business.

ELECTRIC RAILWAYS.

(Special Correspondence.)

ST. JOSEPH, MO.—The St. Joseph Electric Railway Company has been incorporated with a capital stock of $50,000.

BIDDEFORD POOL, ME.—An electric road is contemplated between Biddeford and Biddeford Pool, a distance of nine miles.

DALLAS, TEX.—Thirty-one thousand dollars has been raised toward the proposed Dallas-Waco-Corsicana interurban line.

SAN JOSE, CAL.—The San Jose Terminal Railway Company have announced that San Jose and Hollister will be connected by electric railway.

WATERFORD, WIS.—It is proposed to build an electric line between Waterford and Spring Prairie. Fred Cooper of this city is promoting the project.

OGDEN, UTAH.—The Ogden Rapid Transit Company is said to be planning for the extension of its system to Huntsville, a distance of about eight miles. A.

LORAIN, O.—The Boards of Commerce of Lorain, Amherst and Oberlin have started a movement for a new electric line to connect the three towns.

PITTSBURGH, PA.—It is announced that the West Penn Traction Company will build a ten-mile stretch to connect West Newton with Hunker next spring.

BLUEFIELD, W. VA.—It is contemplated to run a new trolley line between Bluefield and Princeton. B. M. Cohen and other prominent business men are the promoters.

LETHBRIDGE, ALTA.—The city has voted to construct a municipal electric street railway. Bids are being taken. The estimated cost of the work will be about $96,832. C.

GOLDSBORO, N. C.—The Goldsboro, Seven Springs & Swansboro Railroad Company is planning to extend its line from Goldsboro to Seven Springs, a distance of ten miles.

NORTH ADAMS, MASS.—It has been decided that the Kemp Park trolley line will be built. This assurance was given to Mayor Frink by a member of the Railroad Commission.

SANTA CLARA, CAL.—The Peninsular Electric Company has been granted a franchise for an electric line to connect Santa Clara with the interurban system at Meridian Corners.

CHICAGO, ILL.—An appropriation of over $2,200,000 has been granted for the various expenses connected with the drawing of plans for the proposed system of passenger subways.

PHOENIX, ARIZ.—Announcement has been made that the Arizona Railway Company will extend its line to the new Los Palmos addition and that the work will begin at once.

SALT LAKE CITY, UTAH.—A franchise has been granted the Utah Light & Railway Company to extend its tracks along North Main Street to Second Street and thence to Capitol grounds.

YOUNGSTOWN, O.—A street-car line is to be built to Poland. It is believed that the franchise will ultimately become the property of the Mahoning & Shenango Railway & Light Company.

ALBERMARLE, N. C.—It is announced that an electric street-railway system will be built in Albermarle, with an extension to Crowell Mineral Springs. J. R. Moss is one of the promoters.

WAPPING, CONN.—A committee composed of W. W. Grant and L. B. Priest has been appointed by the citizens to have the matter of subscriptions for the proposed electric railway in charge.

LOS ANGELES, CAL.—The Pacific Electric Railway Company will rebuild its narrow gauge line from Gardena to San Pedro, a distance of about thirteen miles. The line as rebuilt will be standardized. A.

PASADENA, CAL.—Bids will be received up to January 9 for the purchase of a thirty-year franchise to operate an electric line along Washington Street from North Lake Avenue to the east city boundary.

DOYLESTOWN, PA.—It is stated that Thomas Deegan of Philadelphia will build a trolley line from New Hope to this place and on to Perkasie. Franchises and rights of way are held by local men.

JOHNSTOWN, N. Y.—The Common Council, of Johnstown, has granted the application of the Little Falls & Johnstown Railroad Company to construct and operate a street surface railroad on West Clinton Avenue.

SEATTLE, WASH.—The Seattle Electric Company has been granted permission to build a single track line on Fifth Avenue and on Bell Street. A franchise for a pole line has been given on other streets in the city. A.

KALAMAZOO, MICH.—The M. U. R. Railroad Company is contemplating the electrification of the road between Kalamazoo and Benton Harbor. An electric line will also be built from Kalamazoo to Grand Rapids.

BOISE, IDA.—The Idaho-Oregon Interurban Company has acquired the Boise Valley Interurban Railway Company. The new owners plan for the construction of a line to South Boise, and from Caldwell to Nampa. A.

KANSAS CITY, MO.—A recent report states that the last portion of Kansas City's cable system is to be electrified. Every one of the old cable lines with the exception of this Twelfth Street stub was rebuilt between 1900 and 1905.

RIALTO, CAL.—The Pacific Electric Railway Company has purchased a right of way for the extension of its line from Bloomington to Rialto, a distance of approximately six miles. It is stated that construction will soon be commenced.

MILWAUKEE, WIS.—The Bucyrus Company has filed articles of incorporation. They will build and maintain electric dredges for large dredge work, and will invest $500,000 in Indiana. The principal office will be at Evansville, Ind.

WATERLOO, IOWA.—At a conference of Waterloo and Parkersburg business men it was decided that a street-car line to Elk Run would be in operation in the summer of 1912. C. C. Wolf, Parkersburg, is very much interested in the project.

FINDLAY, O.—The Columbus, Urbana and Western Electric Railroad has requested permission from the State Utilities Commission to issue bonds to the amount of $5,500,000 to finance a new electric line from this city to Columbus.

WINCHENDON, MASS.—The plans for a street-railway line between Baldwinsville and Winchendon, made by the Massachusetts Northern Railway Company, are well under way and by spring everything will be ready for construction work.

STRATFORD, OKLA.—At a meeting of the Commercial Club it was unanimously voted to accept the proposition of the Rapid Transit Interurban Company and raise the necessary bonus to extend the line between Tecumseh and Stratford.

PHOENIX, ARIZ.—The Salt Lake River Valley Electric Railway Company has been granted a franchise to enter the city on certain streets with its proposed interurban railway which will connect Phoenix with all the principal towns in Salt River Valley.

SAPULPA, OKLA.—Announcement has been made that a New York syndicate has purchased the Sapulpa Interurban Railway and will very soon begin the construction of an interurban line connecting the cities of Sapulpa, Okmulgee, Tulsa and Muskogee.

NORTH YAKIMA, WASH.—The North Yakima & Valley Railway Company (George Donald, president) plans to electrify its system, operating from North Yakima to Naches, a distance of about twelve miles. The improvement is estimated to cost about $350,000. A.

PETERSBURG, IND.—The people of Pike County have taken steps toward the construction of a short interurban line from Petersburg to Patoka and thence to Mt. Carmel, Ill. A bridge will be built across the Wabash River jointly by the county and interurban interests. S.

LOS ANGELES, CAL.—The Los Angeles Railway Company has been granted franchises for the construction and operation of lines on East Thirty-eighth Street, Central Avenue and Jefferson Street, and on Vernon and Vermont Avenues, for a period of twenty-one years. The sum of $5,000 is paid for the privilege. A.

CHARLOTTE, N. C.—The Goldsboro, Seven Springs & Swansboro Railroad Company, recently chartered, has purchased the property and franchises of the Goldsboro Street Railway Company, and is planning for an immediate extension of the car line from Goldsboro to Seven Springs, a resort ten miles from the city.

LOS ANGELES, CAL.—Following the completion of the Van Nuys line the Pacific Electric Company will broad-gauge the present narrow-gauge line to San Pedro from Gardena. By use of the Redondo cut-off between Gardena and Los Angeles a second broad-gauge line will be in operation from the city to the harbor.

CLEVELAND, O.—The Cleveland, Painsville & Eastern Railway has asked permission of the Ohio Public Utilities Commission to issue $211,000 forty-year five-per-cent bonds. The proceeds of the sale of this issue will be used for expenses incurred in constructing a new power plant and reconstructing the transmission lines.

FRESNO, CAL.—Surveyors are now at work for the San Joaquin Light and Power Company laying out the route of a railroad to run from Fresno to Big Creek. The cost of the road will be $1,000,000. It will probably run to the plains by way of Little Dry Creek and connect with the Southern Pacific at the Fresno copper mines.

BROWNSVILLE, TEX.—Sam A. Robertson, San Benito, Texas, who recently obtained a franchise from the City Council for the construction of a street-railway system here, has begun the work of laying the track. It will connect with the interurban system of the San Benito & Rio Grande Railway Company of which Mr. Robertson is at the head. D.

TIPTON, IOWA.—It is announced that a company known as the Davenport, Iowa, City & Western Railroad Company will be incorporated for the purpose of constructing an interurban line between Davenport and Iowa City, with a branch line from the main division to Tipton. C. E. Coon of Omaha, Neb., is the promoter of this company.

PORTLAND, ORE.—The Oregon Electric Railway Company has filed supplementary articles of incorporation increasing its capital stock from $100,000 to $6,000,000. The papers enumerate the proposed construction of new lines as follows: from Natron to Ontario, with branches to Klamath Falls, Agency Plains, Lakeview, and from Lakeview to Goose Lake. A.

ST. LOUIS, MO.—The Grandview Railroad Company has been incorporated with a capital stock of $200,000, and is organized to construct an electric railroad nineteen miles long from the city limits to a cement mill. It is stated that work will commence at once. Frederick Herkert, president of the St. Louis Trunk Hardware Manufacturing Company, is the principal stockholder.

SPRINGFIELD, ILL.—The Springfield Commercial Association has adopted resolutions endorsing the Springfield Northwestern Interurban Railway Company. The plans are to construct a new interurban line from this city to Mason City and Petersburg via Athens and Greenview. Resolutions have also been adopted endorsing the construction of the St. Louis & Central Illinois Traction System, which will operate between this city and Vandalia.

DALLAS, TEX.—It is announced by R. M. Nunelly, Jacksonville, Tex., vice-president of the Trinity Valley Traction Company, that its plans for the construction of an interurban electric railway from Dallas to Palestine, a distance of about one hundred miles, are well advanced and that it is expected the work of grading the line will be started some time in January. Its route traverses a thickly-settled country and passes through a considerable number of thriving towns. D.

DOUGLAS, ARIZ.—The Douglas Electric Railway Company, the Douglas Improvement Company and the International Land & Improvement Company have been merged into one corporation to be known as the Douglas Investment Company, with a capital of $1,500,000. The company plans to increase the capacity of its electric power plant, and the construction of lines to the new Calumet & Arizona and Shattuck Mining Company's smelting plants, and through the Sulphur Springs Valley. A.

PITTSBURGH, PA.—A new electric road, ten miles in length, is to be constructed at a cost of $600,000 by the Coraoplis & Woodlawn Suburban Railway Company, for which a charter is to be asked on January 1, 1912. The towns the new line will touch are Stoops Ferry, Glenwillard, Wireton, Scottsville, Woodlawn and Coraopolis. The officers of the company are: President, Postmaster Dithrich; secretary, Attorney A. C. Purdy; treasurer, Harry G. Graham, Pittsburgh. J. H. Barrett and Charles Gibson, Jr., who were the engineers in charge of the building of the Pittsburgh & Butler Short Line, will act in the same capacity in the construction of this line.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

HILL CITY, MINN.—Bert Wideman has been granted a franchise for a local telephone exchange. C.

SITHERLIN, ORE.—M. A. Ralston and E. Wickizor have been granted a telephone franchise in this city.

SAGLE, IDA.—The Interstate Telephone Company plans for the extension of its lines from Sagle to Blacktail. A.

MITCHELL, S. D.—The council is considering the matter of granting a franchise for a complete telephone exchange. C.

SPRINGSIDE, SASK.—The Saskatchewan Telephone Department has run surveys for a long-distance line to Theodore. C.

OWATONNA, MINN.—The Tri-State Telephone Company will be granted a franchise to operate a toll switching station here. C.

VAN NUYS, CAL.—The Home Telephone Company plans for the construction of a line from Los Angeles to Van Nuys, a distance of about nine miles. A.

PECOS, TEX.—It is expected that work will soon start on the $120,000 worth of new telephone construction work by the Tri-State Telephone Company.

OUTLOOK, WASH.—The Outlook Telephone Company plans for the extension in its system from Outlook to Zillah and Toppenish, a distance of about twelve miles. A.

BROKEN BOW, NEBR.—The Broken Bow Telephone Company has been incorporated with a capital stock of $1,200. E. J. Roberts and Jud Moore are named among the incorporators.

RICHMOND, CAL.—The Pacific States Telegraph & Telephone Company plans to put in a distributing line in this section within the coming year for the accommodation of about 4,000 telephones.

SPOKANE, WASH.—The Mountain States Telephone & Telegraph Company will spend $1,000,000 in Idaho and Montana next year building new toll lines and circuits to the Washington state line.

ROCKFORD, ILL.—The Northwestern Telephone & Telegraph Company has been incorporated with a capital stock of $1,500. George P. Gallaher, George J. King and John H. Camlin are incorporators.

PARKMAN, OKLA.—The Parkman Telephone Company has been incorporated with a capital stock of $5,000. The incorporators are Thomas E. Burton, Frank R. Clark, C. H. Kratz and William Davis.

MARQUETTE, MICH.—The Devils Creek Telephone Company has been organized at Daggett, with the following officers: president, Robert Plutchak; treasurer, Albert Engle; secretary, Henry Lucke.

OLYMPIA, WASH.—The Mission Creek Telephone and Electric Power Company of Cashmere has been incorporated with a capital stock of $5,000. A. C. Jones and E. F. Stowell are among the incorporators.

SPOKANE, WASH.—The Pacific Telephone & Telegraph Company plans for the construction of a new line between Spokane and Ellensburg by way of the Lind district, a total distance of approximately 200 miles. A.

CUTLER, IND.—The Cutler Co-operative Telephone Company has increased its capital stock $6,000. The purpose is to extend and improve the plant. George W. Shanklin is president, and Frank A. Mitchell, secretary. S.

BANGOR, ME.—The Postal Telegraph-Cable Company has issued instructions to its construction department to proceed with the work of extending the line to connect with the Independent Telephone Company.

NASHVILLE, TENN.—The Rosemark Telephone Company has been incorporated with a capital stock of $2,000. The incorporators are E. A. Thompson, J. T. Gragg, W. R. McCalia, H. T. McQuiston, J. C. Irwin and others.

WATSONVILLE, CAL.—Property owners in the Carlton district will soon commence the construction of a private telephone system. A trunk line will be built to connect with the exchange of the Pacific Telephone & Telegraph Company at Watsonville. A.

ORESTES, IND.—The Orestes Telephone Company, which operates a large number of rural telephones in this county, has obtained a twenty-five-year franchise in the town of Orestes, and will at once proceed to extend its service, installing new telephones. S.

T9COMA, WASH.—Theodore N. Vail, president of the American Telephone & Telegraph Company, has announced that nearly $2,000,000 will be expended in extending the telephone lines and making other improvements to the holdings of the Sunset Telephone Company.

TACOMA, WASH.—The Pacific Telephone & Telegraph Company is said to be planning for the erection of a new branch exchange at Tacoma, and many extensions and improvements in its system. The work is estimated to cost $200,000. The company has been granted a twenty-five year franchise at Odessa and will soon commence the installation of a system. A.

VISALIA, CAL.—It is the declared intention of the Ducor-California Hot Springs Telephone & Telegraph Company, which has filed articles of incorporation with a capital stock of $10,000, to build and maintain a telephone system between the towns of Hot Springs, Ducor, Terra Bella, Porterville and Rich Grove. The estimated length of the line is forty-three miles.

NOBLESVILLE, IND.—The Deming Telephone Company has filed articles of incorporation with the Secretary of State. The capital stock is $10,000. The company proposes to build, establish, own, maintain and operate telephones and telephone exchanges and do a general telephone business throughout Hamilton County. James B. Studart, M. Jessup and B. Jessup are directors. S.

ELECTRICAL SECURITIES.

D. Arthur Bowman & Company, St. Louis, is offering Springfield (Mo.) Railway & Light first lien fifteen year five per cent bonds.

Chicago Railways Company will redeem on February 1, $1,200,000 Chicago Railways Company five-year six per cent funding notes, dated February 1, 1908; and $4,776,000 five year six per cent collateral notes. Chicago Railways Company's balance for division with the city for twelve months ended October 31, after seventy per cent operating expenses and $3,278,660 interest, was $1,713,883.

There has been listed on the Philadelphia Stock Exchange $8,203,000 first and refunding mortgage five per cent gold bonds of the Virginia Railway & Power Company, due 1934; and $41,000 additional Welsbach company collateral trust five per cent bonds, making the total amount of the latter bonds listed to date $4,149,100.

Brooklyn Rapid Transit earnings continue their satisfactory expansion. For the first half of December gross increased at the rate of $4.000 per day, compared with $3,500 in November and $2,800 daily in October. The mild weather and seasonal trade conditions were the main factors contributing to this growth.

DIVIDENDS.

American Telephone & Telegraph Company; regular quarterly dividend of $2 a share, payable January 15 to stock of record December 30.

Butte Electric & Power Company; quarterly dividend of one and three-quarters per cent, payable January 2 to stockholders of record December 20.

Cities Service Company; monthly dividends of one-quarter of one per cent on both common and preferred, payable January 1 to stock of record December 20.

Electric Storage Battery Company; quarterly dividends of one per cent on both common and preferred stocks, payable January 2.

Interstate Railways Company; semiannual dividend of three per cent, payable January 2.

Massachusetts Lighting Companies; quarterly dividend of one and three-quarters per cent, payable January 15 to stock of record December 26.

Narragansett Electric Lighting Company; quarterly dividend of $1 a share, payable January 2 to stock of record December 14.

Public Service Corporation of New Jersey; a quarterly dividend of one and one-half per cent, payable December 30 to stock of record December 29.

Republic Railway & Light Company; quarterly preferred dividend of one and one-half per cent, payable January 15 to stock of record December 30.

Susquehanna Railway Company; common dividend of one per cent, payable January 21 to stock of record December 21.

United Gas & Electric Company; semiannual preferred dividend of two and one-half per cent, payable January 15 to stock of record December 30.

Washington Water Power Company; quarterly dividend of two per cent, payable January 2 to stock of record December 15.

Westinghouse Electric & Manufacturing Company; preferred dividend of one and three-quarters per cent, payable January 15 to stock of record December 30.

Winnipeg Electric Railway Company; quarterly dividend of three per cent, payable January 2 to stock of record December 20.

CLOSING BID PRICES FOR ELECTRICAL SECURITIES IN THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

NEW YORK.	Dec. 25.	Dec. 18.
Allis-Chalmers common	1⅜	1⅜
Allis-Chalmers preferred	8⅝	7⅝
Amalgamated Copper	66⅝	66⅜
American Tel. & Cable	*74	*74
American Tel. & Tel.	139¾	140½
Brooklyn Rapid Transit	77	77⅝
General Electric	155	155
Interborough-Metropolitan common	15⅛	15¼
Interborough-Metropolitan preferred	48¾	48¾
Kings County Electric	129	129
Mackay Companies (Postal Telegraph and Cables) common	81½	81
Mackay Companies (Postal Telegraph and Cables) preferred	71	71
Manhattan Elevated	133	133¾
New York & New Jersey Telephone	103	103
Pacific Tel. & Tel.	48	48
U. S. Steel common	68½	68⅝
U. S. Steel preferred	111½	111¼
Western Union	79	80½
Westinghouse common	67½	68½
Westinghouse preferred	*114	*114

*Last price quoted.

BOSTON.	Dec. 25.	Dec. 18.
American Tel. & Tel.	140	140
Edison Elec. Illuminating	293	295
General Electric	155	155
Massachusetts Electric common	21⅞	22¼
Massachusetts Electric preferred	94	94½
New England Telephone	154	157

PHILADELPHIA.	Dec. 25.	Dec. 18.
American Railways	45	45½
Electric Company of America	12	12
Electric Storage Battery common	53	54½
Electric Storage Battery preferred	53	54½
Philadelphia Electric	16⅝	16
Philadelphia Rapid Transit	23¼	23½
Philadelphia Traction	84½	84½
Union Traction	51⅛	51

CHICAGO.	Dec. 25.	Dec. 18.
Chicago Elevated Railways common	30	30
Chicago Elevated Railways preferred	91½	92
Chicago Railways, Series 1	99	96½
Chicago Railways, Series 2	37	36¼
Chicago Subway	¼	¼
Chicago Telephone	136½	138¾
Commonwealth Edison	135¼	135
National Carbon common	106	103
National Carbon preferred	118	118½

PERSONAL MENTION.

H. E. McAFEE, formerly of Denver, Colo., has become district manager of the Mountain States Telephone & Telegraph Company, with headquarters at Butte, Mont.

EUGENE CREED has been appointed advertising manager of the Morris Iron Company of New York City and Frederick, Md. He will continue to direct the sales organization.

GODFREY BOYD has been appointed a special engineer for the Standard Plunger Elevator Company of Worcester, Mass. Mr. Boyd's headquarters will be at 1307 Euclid Street, Washington, D. C.

WALTER L. THOMPSON, New York manager of the Philadelphia Storage Battery Company, is in charge of the new office which the company has opened in the American Building, Broadway and Columbus Circle, New York City.

P. H. HASELTON, of the Fort Wayne Electric Works, read an interesting paper on "The Method of Varying the Speed of Alternating Current Motors," following a dinner served to the Fort Wayne section of the American Institute of Electrical Engineers Thursday evening, December 21.

ANDREW McCORMICK has been elected preseident of the Stockton Terminal & Eastern Railroad. The other officers of the road are F. J. Dietrich, vice-president; E. F. Davis, treasurer; Robt. F. Burns, secretary, and J. E. Adams, traffic manager. The road is owned by the shareholders of the United Investment Company.

H. THURSTON OWENS, consulting engineer, New York City, has been invited to lecture before the New York Section of the Illuminating Engineering Society, on January 11, 1912. Mr. Owens will illustrate by means of stereopticon views his paper on "Modern Prpactice in Street Lighting" with especial reference to New York City.

A. E. BARNES, factory superintendent of the Fort Wayne Electric Works, read a paper prepared by W. P. Gleason, president of the Gary steel works, before the December meeting of the Electric Technic Club on "How Steel is Made." The paper, which was illustrated, explained in detail the working of the great plant, and told in a lucid and interesting manner of each step in the manufacture of steel.

J. BRODIE SMITH has severed his connection with the Manchester Traction, Light & Power Company and the street railways of Manchester, N. H., to open an office for himself. He will act as electrical expert in all matters pertaining to electric lighitng and railway properties and will deal in real estate and loans. He expects to begin business about February 1. Mr. Smith will be succeeded by E. C. Foster of New York City, who has had wide experience in railway and lighting properties.

OBITUARY.

HUGH J. McGOWAN, president of the Indianapolis Traction & Terminal Company and also of the Terre Haute, Indianapolis & Eastern Traction Company and connected with numerous other enterprises, died suddenly at his home in Indianapolis, December 19, 1911. Mr. McGowan had been in poor health for two years or more and had made extended trips to California and Europe in search of relief. He returned from Europe last October feeling greating benefited and immediately resumed his work at his desk. Mr. McGowan was born on his father's farm in Clay County, Missouri, January 24, 1857. He worked on the farm until he was nineteen years of age when he went to Kansas City, where he subsequently became a hostler in the street car barns, a policeman, and marshall of the county, the latter by election. After his term of office expired he became city agent for the Barbar Asphalt Company and in this he showed his capacity to handle large businesses. What proved to be the greatest of these came in 1899 when he went to Indianapolis and took charge of the street car company for eastern bond holders. Mr. McGowan improved the property and service and then evolved the great system of interurban roads operating out of Indianapolis, three of the principal lines being under his management at the time of his death. Mr. McGowan was easily the greatest interurban magnate in Indiana and had but few equals in other states. He was a man of forcible character and great business capacity. He was, too, a man of the most kindly impulses, and owed the success which came to him to his own industry.. Though in the thirty-five years in which he piled up a fortune of more than a million dollars Mr. McGowan gave liberally toward all public enterprises and was a steadfast friend to education.

NEW PUBLICATIONS.

PROMOTION OF COMMERCE.—This pamphlet is prepared expressly for the use of American manufacturers and merchants who desire to avail themselves of the facilities established and maintained by the Government of the United States for the promotion of commerce. A list of special publications is given, together with a resumé of the work of other bureaus and offices more or less related to the promotion of manufacture and commerce.

THE USES OF PEAT.—The results of an investigation that was undertaken to determine whether peat, a fuel widely used in some countries, could be serviceable in the United States are contained in a bulletin, "The Uses of Peat for Fuel and Other Purposes," just published by the Federal Bureau of Mines. The author of the bulletin, Charles A. Davis, the peat expert of the bureau, gives an exhaustive review of the entire problem, both in this country and in Europe, and draws the conclusion that the peat beds of this country are a great and neglected resource, which, when properly and fully developed, will add to our national wealth no inconsiderable quantity of good fuel and of raw material for important arts and manufactures. The author concludes by stating that the greatest use of peat will probably be in connection with properly constructed gas producers.

NEW INCORPORATIONS.

SAN FRANCISCO, CAL.—The Thermo Electric Company has been incorporated with a capital stock of $50,000 by F. C. Morgan, T. S. Crellin, G. T. Marsh and E. M. Mason. A.

LOS ANGELES, CAL.—The Union Coal & Electric Company has been incorporated by R. O. Young, G. C. Beaman, G. R. Williamson and W. H. Packard, with a capital stock of $1,000,000. A.

SAN FRANCISCO, CAL.—The Thermo-Electric Company has been incorporated with $50,000 capital. The directors are F. C. Morgan, T. S. Crellan, M. H. Shoeberg, G. T. Marsh and E. M. Mason.

NEW YORK, N. Y.—The Atlantic Communication Company was recently incorporated with a capital of $100,000 by Paul C. Schnitzler, Charles E. Thorn and Silas H. Dayton. The company will manufacture devices for use in connection with wireless telegraphy.

CLEVELAND, O.—The Crescent Electric Company has been incorporated with a capital stock of $1,000. The object of this company is to engage in general work of an electrical construction and electrical repairing. The incorporators are J. S. Wilson, V. J. Rodgers, R. M. Zimmerman, E. K. Zimmerman and S. E. Wilson.

PROPOSALS.

WIRING AND FIXTURES.—The office of the Supervising Architect, Washington, D. C., will receive sealed bids for installing conduits, wiring and lighting fixtures in the post office at Santa Barbara, Cal., and at Orangeburg, S. C. Bids on the first close on January 29; the date set for the second is January 19. Drawings and specifications may be obtained from the custodian of site, or from the Supervising Architect at Washington, D. C.

FOREIGN TRADE OPPORTUNITIES.

(From Daily Consular Reports, issued by the Bureau of Manufacturers. In replying please mention file number.)

NO. 7718. PUBLIC UTILITIES.—An American consular officer American vice-consul general at Bangkok, Siam, has forwarded two copies of specifications and form of tender for the municipal electric power station for Bangkok city waterworks. These specifications, diagrams, charts, etc., can be obtained by interested firms upon application to the Bureau of Manufacturers.

NO. 7718. PUBLIC UTILITIES.—An American consular officer reports that at the last meeting of a city council in his district it was decided to receive tenders for franchises from companies or individuals to take over all of the city's civic utilities, embracing the water supply, electric light and power service, and street-car system. Persons interested in this proposition should address the mayor of the city in question for full information.

LEGAL NOTES.

POWER-HOUSE EMPLOYE RIDING ON PASS A "PASSENGER."—An employe employed to labor by the day in the power house of a railway company, and who is furnished with a free pass, under a rule of the company, which entitles him to ride on any of the company's cars at any time, and about his own business, during the continuance of his employment, is a "passenger" when riding either to or from his place of labor, and not a fellow servant of the motorman in charge of the car, and is entitled to the same rights as a passenger for hire. If he is injured, or killed, through the negligence of a motorman while so riding, the railway company is liable.—Supreme Court of Appeals of West Virginia in Harris vs. City & Elm Grove Railroad Company, 70 S. E. 859.

CONSTRUCTION OF CONTRACT AS TO COMPUTING COMPENSATION FOR POWER.—A contract between an electric railway company and a power company provided two methods of computing the amount due for power; one at the rate of one cent per kilowatt-hour, meter measurement, and the other at the rate of $3.00 per horsepower, obtained by multiplying the average of maximum consumption of horsepower by the railway company during two fifteen-minute intervals in each month, when the railway's consumption was greatest, the amount to be paid in any month by the kilowatt-hour method not to be less than the amount determined by the horsepower method. It was further provided that commercially accurate integrating wattmeters of the power company should be used in recording the kilowatt-hours, and that a Bristol recording wattmeter should be used in computing the amount upon the horsepower basis. The Supreme Court of Washington holds that the figures used by the court below in determining the amounts to be charged each month having been obtained by using the planimeter and this being the method agreed upon by the contract, the railway company could not be heard to say that it was not a proper method. Then, the voltage required by the contract was not less than 550, whereas upon a few occasions, allowing for a two-per-cent loss in transmission permitted by the contract, it dropped below that requirement, while in some instances the voltage was above the contract requirement during the fifteen-minute periods, which were to be used as a basis for ascertaining the amount of power furnished. But the court can see no breach of the contract in this regard, especially as there was no claim nor contention that the railway company was ever damaged by lack of power, or received less than it required. And the court thinks that little credit should be given to the claim of inaccuracy in the Bristol recording wattmeter, the railway company having been permitted under the contract to test the meters for accuracy. Seattle,, Renton & Southern Railway Company vs. Seattle-Tacoma Power Company, 116 Pac. R. 289.

COMBINATION OF TELEPHONE SYSTEMS.—A long-distance line passing through a town where there was a local telephone system, a contract was entered into where connection was to be made, the local system to take certain improved transmitters and receivers and to pay a small rent therefor, and agreeing that, so long as it retained this connection under the contract, it would not extend its lines so as to conflict with the business or interests of the long-distance company, and would not make any connection with any other telephone lines; and would not extend its lines outside of the county, and would give its long-distance business exclusively to that company. The two companies were not competitors. The long-distance system had not been doing any business of any kind in the town or in the county, and the local system wanted to obtain for its patrons and itself the advantages of long-distance connections. The Supreme Court of Mississippi holds that there was nothing unlawful about this agreement—that it did not violate the anti-trust law. The contract promoted the efficiency of both systems, and made both of greater use to the public, as well as more valuable to the owners. If the contention that this contract was illegal were to prevail, the court must hold that while either of these systems could lawfully purchase the other, and stipulate that the selling system would not engage in business for a reasonable period of time and within a territory reasonably necessary for the protection of the purchasing company, yet when they did the lesser thing of only buying and selling the right to use the long distance in connection with the local business, leaving both systems, and made both of greater use to the public, as well ference by the other, the lesser contract was illegal. If the long-distance company could not thus protect itself, the local system having obtained the right to connect might have connected itself with other systems, and by its contract and through its exchange have connected all the systems around there with the long-distance lines, thus using the long-distance line not only for itself, but for other companies.—Cumberland Telephone & Telegraph Company vs. State, 54 So. 670.

INDUSTRIAL ITEMS.

ALLGEMEINE ELEKTRICITATS-GESELLSCHAFT, Berlin, Germany, has issued a bulletin describing its galvanoscope for testing insulation, and one on turbine-driven boiler-feed pumps.

THE AMSLER GAS POWER COMPANY, Pittsburgh, Pa., illustrates and describes its type C suction gas producer for power fuel, in a recent bulletin. Several drawings of the producer and its parts are included.

C. W. HUNT COMPANY, New York, N. Y., advertises its "Stevedore" plumbago-laid Manila rope in a recent booklet. A folder mailed at the same time illustrates the "Hunt" tension-adjusting couplings. These are used to maintain even tension on ropes where multiple rope drive is employed.

THE YALE & TOWNE MANUFACTURING COMPANY, New York, N. Y., has published a catalog illustrating and describing its chain blocks, electric hoists, trolleys and cranes. The publication is fully illustrated and shows a number of types of hoists and also details of many interesting features connected with them.

THE WORTS-McKISSON MANUFACTURING COMPANY, Toledo, O., has mailed Catalog D on its high-power wireless apparatus. The company makes commercial instruments for private installation, these being of perfect construction and yet sold at a moderate price. The transformers, spark-gaps, condensers, tuners, insulators, etc., listed are not in any way experimental machines, but are carefully worked out.

LEEDS, NORTHRUP & COMPANY, Philadelphia, Pa., describes its calorimeter thermometers of the resistance type in a recent bulletin. This type of thermometer was developed through Messrs. Dickinson and Müller of the National Bureau of Standards. The result of their work has been the production of a type of thermometer which is at least ten times as sensitive as the mercurial thermometer, and the error of measurement is reduced to about one-tenth of the former error.

THE READING IRON COMPANY, Reading, Pa., calls attention to the advantages of its wrought-iron pipe in a recent bulletin. An illustration on the cover of the publication shows how wrought-iron pipe and steel pipe compare after having been in service for a considerable period of time. The steel pipe is entirely eaten through in parts while the wrought-iron pipe has not been visibly affected. The unaffected iron pipe used as an example was in service twenty-one years while the steel casing was only exposed for eleven years.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., reports that Smith, Hauser & Locher & Company have ordered six storage-battery locomotives. The latter company has contracted with the City of New York to build a tunnel for conveying the Catskill water supply from about One Hundred and Tenth Street to Union Square. This tunnel will be about ten feet in diamater, concrete lined and will be driven through solid rock about 250 feet below the street level. To drive this tunnel expeditiously a

series of six shafts will be driven, the distance between two adjacent ones being about one mile. The excavated material will be hauled to the shafts by the storage-battery locomotives and brought from there to the surface by hoists.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, Pittsburg, Pa., has received an order from the Youngstown Sheet & Tube Company of Youngstown, O., for a total of ninety-nine motors to be used in connection with its open-hearth plant. They will be used on cranes, charging machines, strippers, transfer tables, screw downs, and blooming mills. The Youngstown Company formerly used the Bessemer Process and is now installing the open-hearth process and blooming mill for taking care of the open hearth process output. An interesting point of this order is that fifty-six of these motors are the new Westinghouse type M. C. direct-current mill-type motor equipped with commutating poles. This line has been designed to parallel the well known M. T. alternating-current motor which has proved so successful in mill service.

DATES AHEAD.

American Institute of Consulting Engineers. Annual meeting, New York City, January 16, 1912.

Northwestern Cedarmen's Association. Minneapolis, Minn., January 23 and 24.

Western Electrical Inspectors' Association. Milwaukee, Wis., January 23-25, 1912.

National Independent Telephone Association. Annual convention, Chicago, Ill., February 7, 8 and 9, 1912.

Minneapolis Electric Show, Minneapolis, Minn. March 16-23.

Minnesota Electrical Association. Minneapolis, Minn., March 20-22.

National Electric Light Association. Next annual convention, Seattle, Wash., June 10-14, 1912.

National Electrical Contractors' Association. Annual meeting, Denver, Colo., July 17-20, 1912.

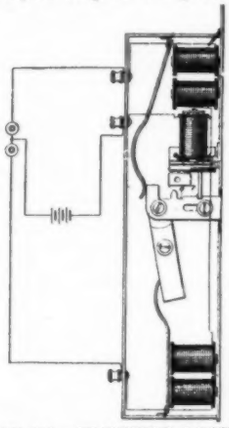
The 1912 Boston Electric Show. Mechanics Building, Boston, Mass., September 28-October 26, 1912.

RECORD OF ELECTRICAL PATENTS.

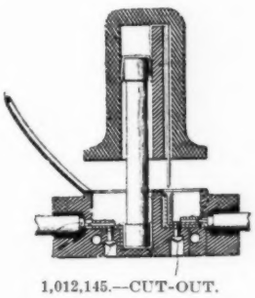
Issued by the United States Patent Office, December 19, 1911.

1,011,898. METALLURGY OF ZINC-BEARING LEAD SULPHIDES WITH OR WITHOUT SMALL ADMIXTURES OF OTHER METALS. E. A. Ashcroft, Sogn, Norway. The ore is dissolved and finally electrolyzed.

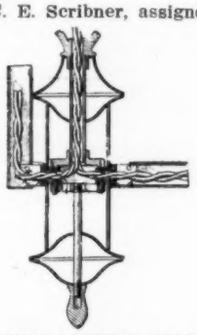
1,011,899 and 1,011,900. METALLURGY OF METAL SULPHIDES. E. A. Ashcroft, Sogn, Norway. Both these patents include an electrolytic step in the process.



1,001,956.—ELECTRIC LOCK.



1,012,145.—CUT-OUT.



1,012,234.—COLLAPSIBLE CHANDELIER.

1,011,910. FITTINGS FOR SUPPORTING ELECTRIC CONDUCTORS. T. Buccholz, Kalk, Germany. Consists of a profile bar to which is secured a U-shaped insulator support carrying an insulator on top of each leg.

1,011,918. FLUID-PRESSURE GOVERNOR. H. W. Cheney, assignor to Allis-Chalmers Co. A motor-driven air compressor is connected to a spring-controlled plunger that is adapted to open and close a switch in the motor circuit at predetermined limits of air pressure.

1,011,919. SYSTEM OF MOTOR CONTROL. H. W. Cheney, assignor to Allis-Chalmers Co. A drum-type controller includes a set of compressible carbon-plate resistances in the armature circuit. The controller handle operates to change the motor connections and also to vary the pressure on the resistances.

1,011,925. TELEGRAPHY. P. B. Delany, assignor to Telepost Co. An automatic telegraph that transmits impulses of one polarity for dots and of the opposite polarity for dashes, each of which is recorded on a tape.

1,011,939. ELECTROSTATIC MACHINE. F. Ghilarducci, Rome, Italy. A machine of the Holtz type has a rotatable ebonite disk.

1,011,942. THERMOSTAT. J. D. Gould, New York, N. Y. Includes a piece of cable supported between terminals; the cable has an inner and an outer conductor connected to a circuit but separated by porous insulation and a fusible metal adapted to flow through the insulation and close the circuit.

1,011,944. INDUCTION MOTOR. A. M. Gray, assignor to Allis-Chalmers Co. Relates to the construction of a squirrel-cage rotor with ventilating fans at each end.

1,011,956. ELECTRIC LOCK. E. H. Hild, Philadelphia, Pa. Electromagnets control pivoted arms and a lever that operate the bolt.

1,011,977. IGNITION APPARATUS FOR HYDROCARBON ENINES. A. Loomis, assignor to Packard Motor Car Co., Detroit, Mich. A tube carries the conductors from the spark coil to the spark plugs at each cylinder.

1,011,980. ILLUMINATING INSTRUMENT. H. T. Martin and J. F. Golden, Baltimore, Md. An exploring outfit with a miniature incandescent lamp at the end of a hollow tube.

1,011,992. DRY BATTERY. D. L. Ordway and J. W. Brown, assignors to National Carbon Co., Cleveland, Ohio. Consists of a set of thin flat cells packed closely in a box; the sides of the cells are in electrical contact with each other.

1,012,010. SELF-WINDING CLOCK. T. B. Powers, London, England. Includes an electromagnetic circuit-closer operatively connected to the main spring.

1,012,020. ELECTROMAGNET. C. E. Scribner, assignor to Western Electric Co., New York, N. Y. A ringer for a telephone bell has part of the electromagnet core rotatable.

1,012,027. CONTROLLER. E. W. Stull, assignor to Allis-Chalmers Co. A drum-type railway-motor controller includes a main switch biased toward open position but maintained closed by an electromagnet.

1,012,059. ELECTROPNEUMATIC BRAKING APPLIANCE FOR RAILWAYS. M. H. Burchard, Chicago, Ill., and R. P. Noble, Portland, Ore. The control station of a so-called "scenic" railway electrically governs a series of pneumatically moved braking devices.

1,012,064. RAILWAY-TRAFFIC-CONTROLLING APPARATUS. F. L. Dodgson, assignor to General Railway Signal Co., Gates, N. Y. A pneumatic motor for throwing a track switch and a series pneumatic semaphore signals are electrically controlled.

1,012,066. INDICATOR FOR TELEPHONE SWITCHING APPARATUS. H. W. Dunbar, assignor to Western Electric Co. A telephone-operator's key has a slidable target to show its alternate positions.

1,012,068 and 1,012,069. INSULATED RAIL JOINT. C. H. Ewing, Haddon Heights, N. J. Consists of a steel channel base plate with insulating slabs under and between the rail ends.

1,012,077. METHOD OF MAKING HOMOGENEOUS MECHANICAL JUNCTURES. A. B. Herrick, assignor to Electric Railway Improvement Co., Cleveland, O. An electric bond is welded to a rail head by having the bond and head heated to welding temperature simultaneously through heat conduction from a resistance electrode pressed against the bond.

1,012,079. RELAY. W. K. Howe, assignor to General Railway Signal Co. A circuit-breaker consisting of a motor mechanically connected to the movable contacts.

1,012,080. TRAFFIC-CONTROLLING DEVICE. W. K. Howe, assignor to General Railway Signal Co. An electric motor for throwing a track switch has a centrifugal governor that controls the circuit at a certain speed.

1,012,081. RELAY-CONTACT MOVEMENT. W. K. Howe, assignor to General Railway Signal Co. Includes an oscillating block with knife switches and contact figures.

1,012,096. BATTERY TERMINAL. W. H. Pearce, Summit, N. J. Has a skirt, washer and nut to secure to it the battery cover.

1,012,102. COUPLING. J. Sachs, assignor to Sachs Co., Hartford, Conn. A main and a branch line are electrically and mechanically coupled together by means of a duplex clamp which grips each line and draws the branch endwise to the main.

1,012,110. OSCILLATING FAN. B. A. Stowe, assignor to Adams-Bagnall Electric Co., Cleveland, O. The motor shaft is connected to the oscillating mechanism by means of an eccentric and reduction gearing.

1,012,125. SWITCH KEY. E. B. Craft, assignor to Western Electric Co., New York, N. Y. Gives details of construction of a telephone operator's key.

1,012,145. ELECTRIC CUT-OUT. T. E. Murray, New York, N. Y. Consists of a base block with two sockets, one for an inclosed fuse and the other for the connecting strip leading to the opposite end of the fuse; a cup protects the fuse and carries the strip.

1,012,146. ELECTRIC SYSTEM FOR DISCHARGING EXPLOSIVES. R. E. Noble, assignor to Morgan-Gardner Electric Co., Chicago, Ill. Consists of a three-wire system with two wires for the firing circuit and one of these with the third for a circuit that indicates whether the shot has been properly fired.

1,012,148. PROCESS FOR THE PRODUCTION OF HALOGEN DERIVATIVES OF HYDROCARBONS. I. Pfeifer and E. Szarvasy, Budapest, Austria-Hungary. Consists in subjecting to the action of the silent electric discharge a mixture of hydrocarbon in the form of vapor and a halogen.

1,012,150. FLUSH ATTACHMENT-PLUG RECEPTACLE. C. D. Platt, Bridgeport, Conn. A base has a center block in an opening with terminals socketed therein.

1,012,198. ELECTRIC-MOTOR STARTER. C. L. Goughnour, assignor to United Electric Co., Canton, O. Includes a centrifugal switch with two spring-controlled centrifugal dogs normally contacting with their respective terminals.

1,012,209. TESTING APPARATUS. L. V. Lewis, assignor to Union Switch & Signal Co., Swissvale, Pa. Consists of a coil of bare resistance wire on top of which is mounted the standard instrument; a sliding contact permits adjustment of the resistance in series with the standard instrument and the instrument to be tested.

1,012,216. STOP MOTION. W. E. Morton, Shelby, N. C. A belt-shifter is moved under electric control when an abnormal condition prevails in the material that the machine subjects to treatment.

1,012,217. MICROPHONE. G. A. Nussbaum, London, England. Consists of solid and perforated plates between which are granules and air spaces.

1,012,227. GLASS-BEVELING MACHINE. J. H. Stich, Davenport, Iowa. Is motor driven.

1,012,231. TELEGRAPHY. M. O. Anthony, assignor to C. H. Walker, New York, N. Y. Includes a set of doubly wound induction coils, the low-tension side of which is connected to the station apparatus and the high-tension side to the line.

1,012,234. COLLAPSIBLE CHANDELIER. G. M. Beardslee, assignor to Beardslee Chandelier Manufacturing Co., Chicago, Ill. Has pivoted tubular lamp arms which fold against the chandelier body.

1,012,240. ELECTRIC SWITCH. F. B. Bowers, assignor of one-half to Edia R. Ramsey, Penn Yan, N. Y. A lamp switch with pull-chain and wheel arrangement.

1,012,257. DYNAMO-ELECTRIC MACHINE. F. Jeffrey, assignor to Allis-Chalmers Co. The coils are fastened to the poles by wedges of a shape to prevent bulging of coils.

1,012,293. ELECTRIC COFFEE-ROASTER. R. H. Talbutt, assignor to James E. Baines, Washington, D. C. Heat is supplied by a set of electric heating coils; the roaster being turned by a small motor.

1,012,296 and 1,012,297. SHADE-HOLDER. G. B. Thomas, assignor to Bryant Electric Co., Bridgeport, Conn. Co-operating clamping members lie above and below a supporting bead on the socket. A split ring is adjustable over the supporting bead.

1,012,298. APPARATUS FOR INDICATING THE CONDITION OF STORAGE BATTERIES. E. M. Tormin, assignor to Holtzer-Cabot Electric Co., Brookline, Mass. A hydrometer supported by the electrolyte, and viewed through a window, indicates the specific gravity of the electrolyte.

1,012,326. ELECTROTHERAPEUTIC APPARATUS. C. E. Campbell, assignor to Campbell Electric Co., Lynn, Mass. Has a high-tension transformer and a high-frequency coil, with a safety device between, and also a condenser interposed.

1,012,335. FIRE-ALARM SYSTEM. O. De Champ, assignor to De Champ Electric Co., Everett, Mass. A number of call boxes. Each give different impulses to the solenoid at the receiving station, causing different numbers to be shown.

1,012,351. TRAP FOR CATCHING AND ELECTROCUTING RATS. M. Gold, New York, N. Y. The rat, after electrocution, is deposited in a receiving compartment.

1,012,365. CLOCK ATTACHMENT FOR ELECTRIC THERMOSTATS. J. C. Kersteter, assignor to Electric Heat Regulator Co., Minneapolis, Minn. The thermostat may be locked against movement, being released at a predetermined time.

1,012,381. DYNAMO-ELECTRIC MACHINE OF THE HOMOPOLAR TYPE. F. H. Loring, London, England. Current is collected from transverse bolts which hold the cup-shaped laminae of the armature together.

1,012,384. BURGLAR PROOF KEYLESS ALARM-LOCK. J. Lyon, Dayton, O., assignor to F. J. McCormick and F. J. McCormick, Jr. Contact is made when pressure is exerted upon the door.

1,012,423. SECTIONAL CONCRETE TELEGRAPH POLE. W. J. W. Orr, Anaheim, Cal. A number of hollow sections are held together by a longitudinal tie bolt.

1,012,456. RADIO TELEPHONY. G. Seibt, assignor to Amalgamated Radio-Telegraph Co., London, England. Covers method for varying the ohmic resistance of transmitting apparatus, and of the system with which it co-operates.

1,012,461. TERMINAL BUSHING FOR ELECTRIC BATTERIES. J. R. Sloan, Altoona, Pa. The terminals extend through openings in the cover of the cell; packing is held in place by a follower screwed into a socket surrounding the terminal.

1,012,470. APPARATUS FOR ELECTROLYSIS OF FUSED ALKALI CHLORIDS. E. Steinbuch, assignor to Society of Chemical Industry in Basle, Basel, Switzerland. Is provided with a diaphragm, and chambers for collecting the electrolyzed product.

1,012,477. ALTERNATING-CURRENT MOTOR-CONTROLLING APPARATUS. A. Sundh, assignor to Otis Elevator Co., Jersey City, N. J. Has coils connected in parallel to the primary source of current, coils in series with the secondary of the motor, the coils controlling means to vary the starting resistance.

1,012,488. APPARATUS FOR PURIFYING FURNACE GASES. U. Wedge, Ardmore, Pa. The dust-laden gas passes in front of the pole of an electromagnet.

1,012,496. WIRELESS RECEIVING ELECTRIC SYSTEM. C. Wirth, Nuremberg, Germany. Covers regulating devices for varying the responsive capacity of the receiving circuit.

1,012,524. APPARATUS FOR AUTOMATIC REGULATION OF RECTIFIERS AND ROTARY CONVERTERS. F. B. Crocker, New York, N. Y. An automatic regulator has a core with a double magnetic circuit and a two-part series winding.

1,012,525. ELECTRIC SWITCH. M. H. Cullen, assignor of one-half to Lenileoti Cullen, Chattanooga, Tenn. The free end of a laterally shiftable blade carries a plug which may be depressed into a socket.

1,012,549. ELEMENTS FOR ELECTRIC RHEOSTATS. J. W. Hoffman and H. M. Rogers, Lansing, Mich. A small tube is contained in a much larger tube of the same length, the two being joined by plastic insulating material.

PATENTS THAT HAVE EXPIRED.

Following is a list of the electrical patents (issued by the United States Patent Office) that expired December 18, 1911:

531,310. ELECTRICAL CUTOUT. Harry Hansen, Everett, Mass.

531,351. FLEXIBLE GEAR FOR ELECTRIC-CAR TRUCKS. Ferdinand A. Wessel and Ernest Egger, New York, N. Y.

531,354. ELECTRIC-CONDUCTOR SUPPORT. Johan M. Anderson, Boston, Mass.

531,366. MEANS FOR CONTROLLING ELECTRIC LOCOMOTIVES. Ernest Egger and Ferdinand A. Wessel, New York, N. Y.

531,365. CONTROLLING ELECTROMAGNETIC MACHINES. William L. Donshea, New York, N. Y.

531,421. ELECTRIC-LIGHTING SYSTEM FOR RAILWAY CARS. Morris Moskowitz, Newark, N. J.

531,422. ELECTRIC-ARC LAMP. Edwin J. Murphy, New York, N. Y.

531,424. ELECTRIC PLUG SWITCH. Augustus H. Palmer, Utica, N. Y.

531,432. STARTINC ALTERNATING-CURRENT MOTORS. Louis Bell, Boston, Mass.

531,441. ELECTRIC RAILWAY. Charles H. McCloskie, Schenectady, and Henry M. Brinckerhoff, Matteawan, N. Y.

531,450. CONDUIT ELECTRIC RAILWAY. William H. Swift, Boston, Mass.

531,486. DREDGING MACHINE AND ELECTRICALLY ACTUATED BUCKET THEREFOR. Colcord Upton, Salem, Mass.

531,499. ELECTRIC LOCOMOTIVE FOR ELEVATED RAILWAYS. Fritz B. Behr, London, England.

531,515. HINGE FOR ELECTRIC APPARATUS. Arthur B. Davis, Elkridge, Md.

531,575. TRUCK FOR ELECTRIC CARS. William Sutton, St. Louis, Mo.

531,614. ELECTRIC CABLE. Theodore Guilleaume, Cologne, Germany.